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EDITORIALS

EDITOR'S NOTE.—The subject of the systematic training of public health officers has been very prominent recently. We have secured in the following three editorials expressions of opinion from a practising sanitary engineer, from a state official and from a physician who combines in himself the functions in part of a deputy state officer, in part of a municipal officer, and in part of a county health officer. All three are men whose peculiar opportunities for the observation of public health matters from their several standpoints have been wide and intimate. Whether our readers agree with these views or not, they cannot help appreciating the sincerity with which they are made, or escape the forcible impression that an evident and immediate need exists for the adoption by professional hygienists of some pretty definite policy with regard to the future development of their own profession.

PUBLIC HEALTH—A NEW PROFESSION

It is apparent to many that the time is ripe for the evolution of another profession, namely, that of public health, a profession which will embody in it some of the elements of several other professions, elements which must be recapitulated under the heading of public health, something more than sanitary engineering on the one hand, something more than mere preventive medicine on the other.

The first professional man was the priest. He was priest, physician, lawyer, and engineer all in one. Moses is the familiar example of the trinity of the old professions, and the "Pontifex Maximus," or the head of the priesthood of pagan Rome, was at the same time the Chief Builder of Bridges as the name implies. One by one medicine, law, architecture, and engineering became separated from the priesthood and in this century many new specializations have arisen until the differentiation has become bewildering in its complexity. However, this specialization is in accordance with the spirit of the age and in that spirit must the future be faced.

The public health work to be done in new communities consists largely of sanitary engineering, while in communities more advanced, whose water supplies, sewerage systems and other items of municipal housekeeping are above criticism, the work is largely in the field of hygiene and sanitation, including the minimizing of contact infection and the house to house instruction of the ignorant and careless in the laws of personal hygiene and cleanliness.

At present the training in public hygiene given to the physician in the average medical school amounts to about thirty hours during the course, while in at least one non-medical technical school the sanitary engineering students have sev-

eral times as many hours of instruction designed to fit them for service in the field of public hygiene.

Notwithstanding his defective training the public reasons that, whereas the physician has to do with disease, therefore he is more competent to deal with problems of public health than any other class of professional men. Therefore it happens that a man with a doctor's degree, regardless of his training, has a better hold on the public than any engineer or sanitary expert, no matter how well trained.

It is the common belief of those best informed regarding public health matters that the work in America will follow two lines, namely, medical and sanitary; *i. e.,* personal and environmental; that the training of the physician fits him better to undertake the former, and the training of the engineer makes him better fitted to undertake the latter work, provided both have enough further training to enable them to consider the problems from a social rather than an individualistic standpoint.

While public health work will probably divide itself broadly along these lines, the smaller cities and all rural districts may have to depend upon one man who in his early professional life is well enough trained in both of these general branches of the work to satisfy all the requirements to a reasonable degree. This of course would mean the placing of the work, in the rural districts at least, in charge of the State, and in order to get the right kind of men, the promotion of the workers from lower to higher positions would have to follow, just as the mayors in Germany are promoted from village to town and city.

All conscientious public health workers realize how imperfect conditions are. One distinguished magazine writer has stated that only a quarter of our public health officials are conversant with their work. The rest are ornamental, and a distinguished visiting German sanitary officer writes, "How corrupt the conditions are in the city boards of health of the

United States may be realized from the fact that the meaning of the expression 'medical politician' is very familiar."

It is obvious that public health work can be carried on best by one trained especially for it. The average medical graduate is ignorant of the statistical method of study and the practical methods of public sanitation. The average sanitary engineer has little or no knowledge of disease and no doctor's degree. It does not seem at all feasible to teach enough of public hygiene within a four years' medical course to be of much practical value to a man who is going into public health work, nor enough medicine during a sanitary engineer's course to enable him to become a satisfactory health officer. The problems of water supply, sewage disposal, contagion and quarantine, and the whole subject of epidemiology cannot be taught without actual contact with the work any more than can medical diagnosis, and extremely superficial work must be performed by some health officers and inspectors who have not had what may be termed a thorough laboratory training in the chemistry, physics and biology of man's environment, a knowledge of the statistical method of study and investigation and some actual observations of public health work as it is carried on in practice. It might be argued that the training in hygiene which is given to the physician would be the best foundation for public health work. The fact is, however, that the subject is not popular with medical students and the laboratory method is seldom used as an aim to teaching this subject. It happens, therefore, that the average medical graduate is woefully deficient in the principles of even ordinary personal hygiene, to say nothing of public hygiene. Nor is this surprising. The other subjects are more interesting and more fundamental to medical practice. Is it not too much to expect of the practising physician that he be expert concerning matters which lie outside of his routine practice? Is it not enough to expect that he be the teacher of personal hygiene in the

home in place of the army of faddists and fakirs who now in too many cases perform that function? It would seem that more good could be done by increasing the instruction in personal hygiene and preventive medical treatment, during the four years' medical course, and by leaving the instruction in public hygiene for after graduation.

The problem is to fill the deficiencies in the training of a medical graduate or of a graduate in sanitary engineering or applied science in order that he may be competent in his early years to accept minor positions and perhaps in later years to grow into the more important ones, specializing as he grows older along the lines of his early professional training, medical or engineering, or in a few cases of pre-eminent ability, taking charge of the general executive work of the State and Government. With a career of this kind open to him, the man who is primarily an engineer and the man who is primarily a physician could equally well afford to devote themselves sedulously to Public Hygiene as a life work, and the demoralizing habit of regarding such work as a mere temporary stepping-stone to reputation leading to successful private practice of engineering or medicine, would disappear.

To suggest a course for the training of a Public Hygienist is difficult. The training which could be given in the immediate future would necessarily fall short of the ideal. It might be well, however, to set up a pattern to grow to. The work of the Public Hygienist is the refinement of our material civilization. Therefore, every study which has a social value would contribute to the general result.

The general preparatory work should include Mathematics, the languages, especially English, German, and perhaps Latin and Spanish. It should also include Economics, History and Sociology. Since the study of public hygiene, as Professor Sedgwick expresses it, is nothing more or less than the study of "Physic, Chemistry and Biology of our environment," it follows that these subjects should be thoroughly

taught to the embryonic sanitarian. Furthermore, they should be taught by the laboratory method. The Biology should include Botany and Zoology, and the Chemistry, qualitative and quantitative analysis and the chemistry of air, water, and municipal and factory wastes.

Graduates in general science or engineering should be obliged to take courses in elementary Anatomy, Histology and Physiology, and a special course in Medicine with due reference to the diagnosis and etiology of contagious diseases. Graduates in Medicine should be obliged to take courses in elementary surveying and mapping, including drawing and plotting, also elementary hydraulics and sanitary engineering.

The main professional subjects should include Bacteriology and Parasitology, the methods of defence against the microorganisms of disease in general, Sanitary Biology, Sanitary Science, Sanitary Engineering, Sanitary Law and Hygiene. The last should include sexual and tropical hygiene and the hygiene of schools, ships and other structures. Where possible all of these courses should be taught by the laboratory methods and visits to public institutions like hospitals, quarantine stations, dairies, schools, etc. For some students special courses in Pathology, Autopsy work, Architecture, Structural Engineering, the Chemistry of foods, Toxicology, Physiological Chemistry and Geology should be given by experts, but the training in the main should rest upon the three fundamentals, namely, Physics, Chemistry and Biology.

For his doctor's degree the candidate should present a thesis which should embody the results of some original investigation which should reveal an ability to attack public health problems in a scientific way.

It is obvious that no institution except a university with medical, engineering and science departments could hope to start courses along these lines with any sureness of success. The graduates should have the degree of "Doctor in Public

Health" or "Public Hygiene." This course would remove the disadvantage under which the well-trained non-medical sanitary expert works at present because of his lack of a doctor's degree, and would remove that under which the medical graduate labors because of his lack of statistical and sociological methods of study and work and his ignorance of engineering. Such a school would have to be conducted for some time before it could rely upon its students for support. At present, however, the supply of well-trained men does not equal the demand. It is gratifying that good beginnings have been made at the Masachusetts Institute of Technology, at the University of Toronto, at Cornell, at Columbia, and at other places, and it is to be hoped that more and broader courses will be offered in the future. Better training for the health officers would be followed by a greater appreciation of their work on the part of the community, also better pay. If broadly trained men were in control of our public health work the misunderstandings which might arise between narrow-minded constructing engineers without knowledge of public hygiene on the one hand, and hygienists deficient in the knowledge of sanitary engineering, yet provided with the power of initiating public sanitary works on the other, would be obviated. The attainment of this ideal is afar off, but it is well worth hoping and working for.

R. S. WESTON.

TRAINING FOR PUBLIC HEALTH SERVICE

No one seriously questions the need for better preparation on the part of the majority of those engaged or seeking opportunities in public health service, whether federal, state, or municipal.

No one entertains any serious doubts of the ultimate inauguration of some plan whereby theoretical and practical instruction in the technical and in the administrative branches of public health service will be made available for the beginners. the recent graduates, and for those already engaged in such service.

The question to be discussed here is, what can be done in the immediate future for the training of the members of these three groups, and upon what basis and by whom should it be undertaken?

It would seem logical to consider the needs of the hour under three heads:—

First: The further training of the existing forces, that is, those already experienced in the practice of the service.

Second: The training of the beginners, that is, those who could take advantage of opportunities to specialize in some of the undergraduate courses in educational institutions, which should lead to a comprehensive graduate training in public hygiene.

Third: The further training of these and others, for teaching and professional work in public hygiene through comprehensive and systematic graduate work leading to a degree in public hygiene, or its equivalent.

Those designated in the first group are relatively experienced in the professional practice of public health, but are generally proportionately deficient in theoretical and tech-

nical training in the fundamental sciences upon which efficient work should rest.

In their instruction it would seem logical to apply our educational efforts by starting from the standpoint of everyday practice and working into the fields of theory and principle. By so doing we are working from the known to the unknown. For the successful conduct of this plan, it would seem to be absolutely imperative that the instruction be given under the direction of, or better, by those who have had a large measure of practical experience in public health work, and who are in close touch with its everyday problems; but who have had, as well, a fair measure of systematic training in the necessary fundamental technical sciences and their application to public health work. If they have also been trained in the science and art of pedagogy, all elements for success will be available.

To make general application of this plan: The courses for health officers should be under the direction of official departments, and taught by their staffs, or under their immediate supervision. This is to insure starting from the practical standpoint. The courses to be attractive, however, must give instruction in the technical operations and fundamental principles upon which actual practice is founded, and this should be given by the experimental method, so far as time permits. To offer courses in public health for health officers of experience, to be conducted by young instructors or assistants of educational institutions, in the departments of bacteriology, pathology, chemistry, physiology, clinical medical diagnosis, various branches of engineering, law, sociology, statistics, etc., is to invite a termination of the subject after the first series of lectures or laboratory exercises, if not before. Even the enlistment of the services of a corps of eminent professors, but who are without experience in the application of their knowledge to practical public health problems, will not greatly enhance the value of the courses, and, therefore, their attraction for the average health officer will be small.

On the other hand, the conduct of the courses by those who have had little or no training in the branches of science of fundamental importance for successful public health work, no matter how experienced they may be in the practice of public hygiene, may result in examples of the blind leading the blind, and no real progress will be attained.

The best hope for the success of such strictly postgraduate courses lies in the utilization of the comparatively small number of workers at present engaged in public health service, who have had training to a greater or less degree, in the fundamental branches of science which have been mentioned, and have likewise come in contact with practical problems, and through the attempts at their solution have obtained actual experience in public health work.

If we should limit our instructors to those in this group who have had experience in teaching these subjects, the number available would be small indeed. In this paucity of the proper teachers lies one of the chief reasons for the lack of development in this field of educational effort in public hygiene.

The existence of so few of such courses is probably not, as is generally supposed, due to lack of willingness on the part of health officers of municipalities to attend and profit by them. The marked enthusiasm shown by those who have attended the few courses which have been given in the laboratories of the New York State Department of Health, has convinced the writer of the great desire of large numbers of health officers to obtain further training and their willingness to make considerable personal sacrifices to attend short practical courses, given by men possessing both technical knowledge and practical experience.

It would seem to be the function of the state to project and support such educational efforts, under the direction of state boards, or departments of health. However, for ease and a great success in their conduct, co-operation with some educa-

tional institution is most advantageous. Where the facilities of a state university, college, or well equipped normal school can be utilized, and the assistance of members of their faculties can be obtained for the preparatory efforts, then a greater measure of success may be confidently expected. However, actual work in the official offices and laboratories is essential for the final instruction.

The chief requirements are, brevity of the course to secure the economical use of the time and resources of the health officer, and the development of the instruction from the standpoint of public health practice towards the principles and theories upon which that practice rests.

It is doubtful if the inauguration of such courses in connection with the branches of the federal bureaus or services, would be successful in attracting the health officers or health officials of small municipalities. These federal departments are not in close touch with the majority of municipal or local problems, and have no everyday association with them. Their officers do not possess, therefore, the qualifications as to practical experience which we have outlined as essential for the instructors in this field.

The federal departments might, however, to the very greatest advantage, become the leading spirits in the development and improvement of the various branches of work engaged in by the state boards and departments, by educational measures such as conferences, courses, etc. They might be, and they are, to some extent, the leaders in scientific research in fundamental problems, in the development of standard methods, in the promotion of uniformity of interpretation of results, and especially in the unification of the legislative and administrative activities in the separate states.

In other words, theirs should be the higher educational field, contributing results to be utilized by the state offices in educational efforts for the betterment of their own and the municipal health services.

The second field of educational action in public hygiene, namely, with the beginners, has been most admirably dealt with in the preceding editorial, and need not be considered here in any detail.

In principle, the instruction will be by induction based upon the experimental method. Those giving the instruction probably will not, and it should hardly be required that they be, experienced in the practice of public hygiene. It will be sufficient that they be familiar with the principles of the subject. In those universities or large institutes where graduate work as outlined under group three is conducted, the instruction for the beginners should be under the supervision, or at least the instructors should be guided in the scope and method of their teaching, by those in charge of the graduate courses.

The third field of educational effort toward efficient public health service has likewise been carefully and amply considered as to its scope and general direction by Mr. Weston. It will be sufficient here to emphasize the almost paramount necessity for a large measure of actual practical experience in public health work, on the part not only of the director of the course, but also of the heads of the important departments giving the graduate or advanced instruction in those branches of the natural, medical, legal, engineering and sociological sciences, which should make up this full course of study leading to a degree in public health.

It might be said that the practice of public hygiene requires not only the utilization of all facts of the natural sciences, but also the application of all the principles and methods of the science, and the art of the utilization of that knowledge. Instruction and training for its service cannot more logically be given by those deficient in the science and art of utilization, than by those lacking in the knowledge itself. Therefore, the close association or utilization of the official public health and welfare services in the fields of education in public hygiene, especially in the recent graduate and post-

graduate courses, is as essential for success, as the association and utilization of the hospital and dispensary for the training of practitioners of medicine, and of the courts for the successful education of the members of the bar.

Probably nothing would have greater influence in excluding undesirable types of politics and politicians from the public health services, and make for the continuance in office of capable officials, than such close association of official and educational efforts.

On the other hand, doubtless nothing would stimulate more active efforts on the part of the workers in educational institutions towards the solution of many of the, as yet, almost untouched scientific problems of basic importance, than the almost constant facing of such problems by some of them in their official capacities.

If it is not feasible to look, at this time, for official financial support for the development of this plan of cooperation, the educational field in public health will offer vast opportunties for the successful use of contributions from the large resources of privately endowed foundations for the betterment of the conditions of human existence.

While ultimately the development, as well as the practice of public hygiene will be, in all probability, matters for governmental action, the consideration of immediate needs should lead to the utilization of every resource toward th inauguration of systematic work in training for public health service.

The success of the immediate efforts which may be made will be determined, to a very large degree, by the extent of the association of educational endeavor with the actual practice of public hygiene.

HERBERT D. PEASE.

HARMONY IN PUBLIC HEALTH WORK

It is quite apparent, from many points of view, that we are now witnessing a great wave of civic reform; a tendency toward better things; a something which is making the "good enough" of a few years ago, insufficient; and the corrupt, intolerable. A certain social betterment is demanded of the future, and Social Workers, Economists, Lawyers, Engineers, Ministers and Statisticians are all taking their places; they are showing us their equipment, the armaments they are to use and the results to be obtained.

It would seem that this is a fit time for physicians to orientate themselves, so as to take the part in this movement to which their position and attainments entitle them. Not that physicians have been denied that position in the past, for they certainly have been for long the foremost, but rather to retain their leadership in the great new revival and to maintain it by reason of real fitness. First of all it is for us both, physicians and sanitarians, to know our limitations. We must throw off some of our aloofness and work in harmony with all other social agencies for common betterment. It is for us to recognize that we are entitled to speak as experts upon only such things as our education and training justify. In the course offered at the leading medical schools men are trained largely to treat disease in the individual, and usually it is from the point of view of the disease itself rather than from that of the sick human being. Disease in the mass is only hinted at when mentioned, and our best sanitarians have come to feel that the usual medical training does not fit the average man for places of trust in public health work. Yet there are very few medical men who do not feel themselves competent to cope with any and all sanitary problems,

and the public regards their opinions as being as good in these matters as they are in the treatment of a Pott's fracture or a bronchitis. This is manifestly unfair to the really trained sanitarian and a great stumbling block to the public, because from it comes a very great confusion of opinions and of "authoritative" statements.

As a nation we have begun to conserve material wealth. It is as surely coming to be felt, that the health of the public, the efficiency of workers, the "public safety" in brief, is one of the greatest resources we have. As physicians and as sanitarians we feel this keenly. Yet we are liable to greatly overestimate the bearing of disease alone, upon this efficiency. To be sure disease is a very large factor, but in addition disease has as its co-workers, tenement crowding, needlessly dangerous employments, intemperance, immorality, ignorance and many others. Physicians are not trained statisticians, or expert engineers; they are usually not good moralists, and are proverbially poor business men. The contention is that in this great uplift, all possible experts should be working in harmony. But let us as physicians and as sanitarians do some of the harmonizing. We are continually bewailing that fact that we are misunderstood, that governing bodies are nigardly in support, that the public are following fads, and that as individuals we better nurse our grievances in silence. But from the other fellow's point of view, what have we done to show our appreciation of the work of the statisticians, or the man who understands poverty in the abstract? It is time for us to come out of our shells and have heart to heart consultations. Then alone can we be enabled to make in conference a true diagnosis of social ills.

If we fail to do this we will find that the economist, the preacher, the lawyer, or all combined will in the future take the reins and we will be supplanted; we will be made to assume the position with relation to those forces,

which the plumber or painter holds with the general contractor. The average physician is no more entitled to speak with authority upon all maters concerning public health than a photographer is to paint a good landscape.

The time should come when at least central boards of health will recognize this and make use of all the other experts in their respective lines. That medicine should yield the leadership of these "Boards of Public Safety" to any others we can never believe. We feel that the education of the thoroughly equipped medical sanitarian in essential bases of the "Humanities" has been broader and deeper than that of any of the other professions concerned. But to ensure and maintain this leadership, both the physician and the sanitarian must cultivate a very broad point of view.

We have everything to gain and nothing to lose. It is our duty to interpret our particular field to the public. Unless we voluntarily do this the others will be grasping at half truths of medicine and giving them to an eager public in a form so palatable that they will be swallowed whole regardless of their content. For this medication the public has been generously trained by the various "Science" cults. It is probable that what these cults are doing for the banishing of disease, the Socialists and other unsettled enthusiasts are trying to do for economic ills.

E. L. TUOHY.

SPECIAL ARTICLE

NOTES ON THE VOGES AND PROSKAUER (1) REACTION FOR BACILLUS COLI COMMUNIS

By FRANCIS D. WEST

Chemist in Charge Torresdale Laboratory Bureau of Water, City of Philadelphia

Incubate a dextrose culture of the organism for 48 hours at 37 1-2 degrees C., in Smith fermentation tubes for the estimation of the amount of gas produced. Fill the tube with 2 per cent. Na O H solution; close the end with the thumb or better by inserting a rubber stopper. Invert the tube to absorb the C O2 by the Na O H. After the gas absorption is made, the tube is stood aside for 24 or better, 48 hours. (MacConkey 2, 1905.) At the end of this time, certain cultures take on a peculiar coloration, brownish to red, usually only in the open arm, through occasionally the color extends up into the closed arm as well. This color resembles eosin. According to Hardin (3) the substance is acetyl methyl carbinol, and is produced by a certain bacteria that decompose dextrose. Rivas (4) 1908, describes three tests, one of which seems to be the Voges and Proskauer reaction carried out in a somewhat different and shorter way, and one of the others has some bearing on the subject.

They are as follows: "If 1-4 cc. of 48 hr. cultures of various organisms in dextrose broth are rapidly boiled in about 5cc. of a 10 per cent. NaOH solution, there will appear immediately after boiling a yellowish lemon color in the tubes

of Bacillus *coli communis* or in the dextrose control; in others the solution will remain clear and colorless, taking on a pinkish color after five to ten minutes."

The other test is for the presence of sugar. This can be made by adding 1-4 to 1 cc. of the culture to Fehling solution and boiling to reduce the copper.

In the laboratories of the Bureau of Water for the past four years we have been making the V. and P. as one of our routine tests for *coli*. We have never obtained this red reaction with pure cultures of *coli*. Cultures of B. *lactis aerogenes* and B. *cloaceae* give it invariably. More recently we have carried along tests No. 1 and No. 3 of Rivas (4) in connection with the Voges and Proskauer reaction. We note that test No. 1 and the V. and P. reaction are identical. When the V. and P. reaction was obtained, a pink color was shown by test No. 1.

Test No. 1 is more delicate; however, as in the case of the V. and P., the yellow color of the medium often gives rise to a brownish coloration making the reaction indefinite.

We have made the following notes as a result of our work on these tests:

Sterile glucoses on heating with 5 cc. of 10 per cent. NaOH gives a yellow coloration. The depth of the color depends on the amount of glucose present. The sugar is probably caramelized by the NaOH.

Lactose solution becomes yellow to brown, depending on the amount of sugar. Saccharose gives a light yellow color, becoming colorless cold. This corresponds with the Fehling test for sugar. Lactose and dextrose reduce Fehling, while saccharose does not. .0025 per cent. glucose is perceptible by this test. This yellow color disappears on the addition of H_2SO_4, but does not reappear, if alkali is again added in excess.

This "red reaction" (test No. 1 or V. and P.) can take place both in the presence or absence of sugar. In other

words this coloration can take place without all the sugar being fermented. On the other hand, the sugar may be all used up and the red reaction not take place

This red color is discharged by acid (H_2SO_4) and reappears with excess of NaOH. It cannot be extracted with ether, alcohol or xylol. Certain cultures of sewage streptococci and staphylococci, also a culture of a bacillus that gave 3 per cent. gas in Smith in 48 hours, were tested; sugar was absent and the red coloration was obtained, showing that a large per cent. of gas is not necessary to obtain the "red reaction" although cultures of B. *cloaceae,* which usually give 90 to 100 per cent. gas in 48 hours, always give the red color with NaOH.

Some cultures of cocci tested showed the presence of sugar after 48 hours. Sugar was present in cultures of B. *coli* after seven days.

The red color of test No. 1 deepens on standing or by blowing into the tube, showing that the color is probably due to oxidation. This is further shown by the fact that the V. and P. reaction takes place in the open arm of the Smith tube.

In view of the increased importance of the V. and P. reaction, MacConkey (5) has used it as one of the tests used by him in differentiating the members of the Aerogenes Coli group, which work has further been carried out by Bergey and Deehan (6), and which will do much to increase our knowledge of a group of organisms about which too little is now known.

I think that the Rivas improvement on the Voges and Proskauer reaction (though Rivas fails to note the similarity and gives it as an original test) is a test that will prove of value.

If the yellow color appears on heating the culture with 10 per cent. NaOH it will show the presence of sugar. (Rivas test No. 3 being unnecessary). After heating the tube shake well or blow through it to bring the red color out. By this

method, the V. and P. reaction can be obtained in a few minutes without being obliged to wait 48 hours for a color that may be masked in that time by the yellowish tint of the media.

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EDITOR'S NOTE.

At the Winnipeg meeting of the American Public Health Association it was voted by the Publication Committee to make the American Journal of Public Hygiene the official organ of the Association, and to contract for 400 pages, of which 175 were to be devoted to the Association, and 75 pages each to the three Sections. It was also voted to suspend the publication of the annual volume of Transactions, owing to the excessive cost of publishing and distributing the same, and to have the American Journal of Public Hygiene sent free of cost to all members of the Association not in arrears.

But 400 pages were contracted for, owing to the necessity of reducing the amount of money spent for printing to a sum within the resources of the Association. It has therefore become necessary to have papers abstracted for publication.

The Journal is printing the papers in the order and as received from the Publication Committee, and is therefore not responsible for the time of publication, nor for the selection of papers to be abstracted, this duty falling upon the Publication Committee.

AMERICAN PUBLIC HEALTH ASSOCIATION

TYPHOID FEVER IN THE PROVINCE OF MANITOBA WITH SPECIAL REGARD TO THE CITY OF WINNIPEG *

By Drs. R. M. SIMPSON, Chairman Prov.-Board of Health, Manitoba, and A. J. DOUGLAS, M. O. H.

Typhoid fever appears to have existed in Manitoba since the early pioneer days when the country was inhabited by Indians, Half-breeds, Fur-traders, Hudson's Bay men, and a few Colonists.

In the year 1870, the Country was acquired by the Dominion of Canada from the Hudson's Bay Company, and very soon settlers began to arrive to take up land. New material thus became available for the disease, and it became quite prevalent, particularly in what is now the City of Winnipeg. At this time it was popularly known as Red River Fever, and was supposed to be due to peculiar conditions indigenous to the Red River Valley, and to be particularly associated with the drinking of water from the Red and Assiniboine rivers.

Dr. O'Donnell (who was here at that time and is still practicing in Winnipeg) states that the symptoms of this affection were characteristic of typhoid. He also mentions the great number of new arrivals who were attacked, and explains this by saying that the old timers seldom drank raw river water, but always made tea, carrying their pannikins with them wherever they went. The new arrivals had not yet acquired this habit and suffered accordingly.

* Read before the American Public Health Association at Winnipeg, August, 1908

Since the year '72 typhoid fever has never been wholly absent from the community.

In the years '81 and '82 occurred the celebrated Winnipeg boom. A great volume of immigration rushed in. The city underwent a mushroom growth, and, as was to be expected with so many new arrivals unaccustomed to their surroundings, and compelled to live, many of them, in overcrowded and insanitary premises, typhoid fever flourished with renewed vigor, and the number of cases increased proportionately with the population.

The rapid expansion of the city, impelled the City Council to assume the initiative and put the city in a sanitary condition. Previous to this Winnipeg had no sewers, no pavements, and no water-works. Water was hawked about the streets in picturesque but unsanitary two-wheeled carts.

The awakening of the municipal conscience resulted in the establishment of the first sewers of our present system, and, later on, in the inauguration of a public water supply—the latter being under the control of a private company. The company's supply was derived from the Assiniboine river at a point which was then considerably above the settled portion of the city, and was filtered before being pumped into the mains. The watershed of the Assiniboine at this time was sparsely populated; no communities discharged their sewage into it, so it might be classed as a moderately good supply. Its drawbacks were its great turbidity at certain seasons of the year, and its hardness.

A number of public wells were sunk at this time in various parts of the city, and from these a pure water, but very hard, was obtained.

Notwithstanding the installation of a sewerage and water-works system, it was not made compulsory for individuals who had houses already constructed, or who might build new houses, to avail themselves of those improvements, and, consequently, out-houses were in general use. These were of the

primitive earth-pit type, and their contents were removed at intervals and deposited on a dump on the outskirts of the city.

When the inevitable reaction that follows all booms came about, it left the city gasping, as it were, for breath. The installation of improvements languished for a number of years, and the population increased slowly.

In the year 1888, what was designated originally as a dry earth system was put into operation. This led to a gradual extinction of the pits, and in ten years' time but a few hardy survivors of these remained.

In spite of the great things expected of the earth system, it was found to be a matter of the utmost difficulty to carry out its requirements properly in Winnipeg. The boxes were abandoned altogether during the winter months, and privy contents simply reposed on the surface of the ground, and were removed with pick and shovel from time to time.

On the arrival of Spring, the boxes were replaced, and an effort made to carry out the regulations. But bad habits once acquired are difficult to break, and partly on account of people having gotten out of the way of using earth, partly on account of the difficulty of obtaining this, and partly from carelessness, the dry earth feature was gradually eliminated, and there came into being that changling child of the earth system which we in Winnipeg have come to know as the box closet.

This was simplicity itself, and consisted of a more or less water-tight wooden box above the ground, which could be removed and cleansed by opening a hinged flap at the back of the building, and which was used during the Spring, Summer and Autumn. In Winter, closet contents lay on the ground, and were removed with pick and shovel.

It is to the conditions engendered by the presence of large numbers of these box closets that much of our typhoid has been undoubtedly due.

In the late nineties, the Water Company's plant was bought

out, and the water-works became a municipal concern. The river water was found to be unsatisfactory in quality, and an effort was made to improve our supply. On the recommendations of Mr. Hering of New York, and Col. Ruttan, City Engineer, the source selected was a deep well which was sunk on the outskirts of the city, and from which water of a high degree of purity was obtained. Water from this source is in use at the present time, and six other wells have been added to keep up with the growth of the city.

In spite of the fact that our water supply was above suspicion, our typhoid rate rose from year to year, and Winnipeg presented a somewhat anomalous picture of a city with a pure water supply and a high typhoid rate.

Matters continued thus until, in the year 1902, commenced what might be called Winnipeg's second boom.

Winnipeg began to grow by leaps and bounds. So great indeed was this growth that the population doubled in three years.

Again, in an aggravated form, were repeated the experiences of '81 and '82. Houses were constructed rapidly, without improvements, as new areas were built upon. Overcrowding took place in the older quarters of the city, particularly in the unimproved portions. The places where they could live cheapest attracted large numbers of European immigrants, many being from Southern Europe, and their ideas of sanitation were, at best, of the most rudimentary description.

In 1902, population 48,411, there were 356 cases; in 1903, population 56,741, 489 cases; in 1904, population 67,741, 1275 cases; in 1905, population 79,975, 1,906 cases; in 1906, population 101,057, 1,174 cases; and in 1907, population 111,729, 387 cases. This includes cases originating outside the city and coming in for treatment—these run about 20 to 25 per cent. of the total.

When typhoid in 1903 began to take its upward course at

such an alarming rate, we endeavored to get at the reason of this, and if possible, to remedy the conditions responsible for it. One of the most notable features of our Winnipeg typhoid has been its constant relation to season. Prevalence was always slight in all months up to July. When August came the number of cases always increased with a bound. This increase continued throughout September and reached the maximum in this month. In October a diminution was noticeable; November displayed a marked falling off, and, by the end of December, what to us were normal conditions, were practically reached.

There was but one exception to this rule. During the Winter of 1904-5 typhoid prevailed to a considerable extent in one of the best residential section. This outbreak, however, was in all probability due to infected water accidentally gaining entrance into the city mains in a limited area. It thus differed etiologically from the vast majority of cases in the city, and therefore, bore practically no relation to our annual autumnal visitation.

Our investigations showed that not only was seasonal influence very constant, but also that prevalence was almost entirely within certain well-defined areas. These districts were the ones in which unimproved houses abounded, and where box closets were extensively in use.

Separating Winnipeg into two parts, North and South, taking one of our prominent streets, Notre Dame Avenue, as the dividing line, we found in the south district where nearly all houses were furnished with improvements, 549 cases of typhoid in the years '03, '04 and '05. In the north district where box closets dotted the landscape at frequent intervals, during the same period occurred 1,983 cases.

Particularly striking was the fact that as soon as the evenings began to grow cold, that is, in August, and the flies were driven indoors, that the typhoid rate rose, and when the first

hard frosts of Winter set in, and snow fell early in November, that a diminution at once took place.

Box closets offered every possible facility for flies to act as infection carriers, excreta being above ground and entirely accessible, and the light not excluded. It was the commonest thing not only to see flies swarming in these places, but also to see abundant evidence of their actually breeding in them.

In many congested portions of the city, long rows of these closets abutted on a lane; a ditch usually ran alongside of the lane, and, as the closets overhung the ditches, a large proportion of the contents found its way into it. The condition of some of these lanes beggared description.

In addition, in these districts the usual run of houses were unscreened, and, during the warm season, on entering any of these dwellings, one could be certain of encountering an army of flies, and could observe processions of them passing in and out of the doors and windows.

In these parts of the city, with such quantities of potentially infectious material present, to say nothing of the dangers arising from convalescents and walking cases, it can readily be seen what unlimited opportunity existed for the conveyance of the disease. Food, flies and fingers were always active.

Among the foreigners there was the ever present difficulty of getting at the cases. These people, speaking little English, and unaccustomed to our ways, had an ingrained dread of doctors, and would seldom call one until the patient was in extremis.

It was a frequent occurrence to visit houses and find two or three typhoid patients being cared for in one room where the cooking was done and the food kept, the individual who was doing the cooking usually acting in a nursing capacity as well.

Even after the case was discovered, our troubles were by no means ended, for the patient, his family, and his friends

would usually offer strenuous objections to going to the hospital, which they regard as a sort of an experimental vivisection station from which they felt sure that those who entered stood poor chances of ever emerging alive. Forcible removal under the Provisions of the Health Act thus became necessary in these cases.

With typhoid constantly present among the inhabitants of certain districts, we naturally got small outbreaks and odd cases occurring in other parts of the city, sometimes the infection being carried by individuals who worked in one place and lived in another, and often by the agency of milk and other food.

Again, individual cases would occur in the best portion of the city, in which we were quite unable to ascertain the cause.

The situation in brief was: A city with all its inhabitants drawing their water supply from one source; the water being of a high degree of purity; typhoid constantly smouldering in certain unsanitary districts, great outbreaks, taking pdace in these every Autumn and, coincidentally, small outbreaks occurring in other parts of the city which would usually be traced to these perpetual foci, it appeared beyond peradventure, that typhoid would continue to flourish until the whole sanitary aspect of large areas of the city was entirely changed, and infectious material rendered inaccessible. It also appeared certain that flies were probably the most active agents we possessed in disseminating infection. In no other way could we explain the occurrence of so many cases in the months of August, September and October, when all conditions were practically the same as in other months of the year except the presence of myriads of flies.

In 1903 the City Health Department brought this question to the notice of the governing bodies, and suggested that steps be taken to do away with box closets, but, as the outbreak that year subsided quickly with the advent of cold weather, no definite steps were taken.

In 1904 typhoid appeared early in August, and the number of cases quickly increased. The Provincial Board of Health took the matter in hand and discussed the whole situation with the city authorities. The report of the Board was very explicit. The principal recommendation was that the City Council at once get power to abolish box closets, and insist on sewer connection to all houses where such conveniences were available. This was the year in which occurred our Winter outbreak, probably water borne, which caused wide spread discussion and alarm. All sorts of theories to explain this visitation were advanced by professional men and laymen, and finally the Council called in Prof. E. O. Jordan of Chicago to investigate conditions and make a report on the typhoid problem.

Mr. Allen Hazen of New York was also called to report on our sewage and water system.

Professor Jordan's report was exhaustive and specific. He recommended that increased power be obtained for the Health Officer for isolation of cases and disinfection of the premises where these occur.

He made a plea for the more prompt notification of cases, and his most important and far-reaching recommendation was that box closets be entirely done away with, and that sewer connection be made compulsory whenever possible; also, that typhoid cases be not allowed to remain in houses which operate an outside closet.

Other suggestions were: Better control of the milk supply, and the doing away with private wells.

The City Council took up the question with vigor, and obtained power from the Legislature, at its next session, to compel sewer connections within a limited area. Box closets were declared a nuisance, and their construction forbidden within the City Limits. We had to face the problem of providing a substitute for these on streets where sewers and water-mains were non-existent, and on those outside the area of compulsory plumbing.

It was decided, after much consideration, that the type of outhouse best suited to our climate conditions, was a water-tight pit, to be constructed of brick laid in cement, with a cement floor six inches thick, three feet in width, and four feet deep, the top of the walls to be carried six inches above the level of the lot.

When this type of closet was first introduced to the public, it met with strenous opposition. All sorts of dire predictions were made as to what would happen if contrivances of this kind were allowed. We were told that the greatest draw-back would be that the pits would freeze to the bottom in Winter, and would crack and fall to pieces.

As a matter of fact these prophecies have not come true, and we have found the pit, while far from ideal, about the best compromise on sewer connection that we can get for general use in our climate. The contents but slightly freeze in the Winter, and can be removed all through that season of the year. Also, flies do not go down into the pits in very great numbers, as the interior is dark and the contents almost entirely liquid. Disinfection can be carried out satisfactorily and readily.

In the year 1905, typhoid prevailed to an even greater extent than in 1904, and in this year we reached the maximum number of cases and highest typhoid death-rate. The Council returned to the Legislature and asked for an extension of the area in which to make plumbing compulsory. This request was granted. Power was given to take in all houses in the city on streets where sewer and water existed, and also, what was very important, it was made possible in those instances where people were too poor, or for other reasons unable or unwilling to have the necessary work done at their own expense, for the city to do it and charge the cost as a tax upon the property, spread over a period of seven years.

Brick pits were only allowed on streets where no sewer or water existed.

The crusade was pushed vigorously, and only those who have been through similar experiences can appreciate the difficulties encountered.

At the time operations were commenced against the outhouse, January, 1905, there were in the city (which was much smaller than it is now) 6153 box closets and 189 pits. At the end of the year there were 2,255 box closets, of which 842 were added by the taking into the city of two suburbs. In June, 1907, there were 458, and at the present time there is one box closet in old Winnipeg and about 16 in the new suburbs.

Plumbing has been installed in nearly all these premises, but we have still 1,650 brick pits, these being in localities where sewer and water are not available.

In order to effect this metamorphosis, it was necessary to invoke the aid of the law very many times. We had, altogether, in connection with the installation of these improvements, over 2,000 police court prosecutions.

Hand-in-hand with this branch of the work went more drastic regulations along other lines. No case of typhoid was allowed to remain at home unless the conditions were such that proper isolation could be obtained, and that excreta could be handled in a manner precluding, as far as possible, the chance of infecting others. Rigid disinfection of premises was carried out in all cases.

The use of metal garbage receptacles were insisted upon, also that manure should be kept in covered boxes and removed frequently and regularly to avoid, as much as possible, affording breeding places for flies.

The Provincial Board of Health and the local Department distributed literature on typhoid prophylaxis, and on the care of cases. Circulars were issued instructing people to screen their houses, and to keep down the number of flies by the use of fly paper and other means.

Milkmen were instructed as to what their duties were,

particularly as to the importance of immediately notifying the local Department of illness occurring at any dairy, and penalties were imposed for failure to do this, and a more rigid system of inspection at the places was inaugurated.

It is the practice to disinfect all pit closets at regular intervals with lime solution, and by frequent removal of contents to keep them as clean as possible.

Careful supervision is exercised over the water supply, and a large number of public and private wells have been closed. Low lots were drained or filled in, rubbish heaps were burned or destroyed, lanes paved or graded, many unsanitary premises were closed altogether, and work along these lines is still going on.

Last year some result from our efforts was evident, and, from indications, the present year will exhibit an even more satisfactory showing, as up to the present we have only had 160 cases, which is considerably less than last year's total at the same time.

We recognize, however, that the work here is only beginning, and that it will require unremitting industry to keep abreast with the constantly changing conditions. Many difficulties still confront us, but we hope, with the lessons of the past, to overcome them more swiftly and effectually in the future.

CHARACTERISTICS OF TYPHOID FEVER IN THE MIDDLE WEST*

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The following paper, professing to give the characteristics of typhoid fever in the Middle West, is based entirely upon the records of a single hospital. A word of explanation, if not apology, is therefore necessary. The General Hospital of Winnipeg, Manitoba, was organized in 1872, and incorporated in 1875. Since then it has grown from a capacity of less than forty beds to over three hundred beds at the present time, and has admitted into its wards during that period, over 35,000 patients. Of these no inconsiderable portion has consisted of cases of typhoid fever. About 4,800 cases diagnosed as typhoid fever are on record in the hospital register for the last twenty-six years. Of these about 3,500 were residents of Winnipeg, the remaining 1,300 being resident at various points in Manitoba, Western Ontario, Eastern Saskatchewan, Northern Dakota and Minnesota. In 1883, the Manitoba Medical College was incorporated, and has remained until the present day, the only centre of medical education in Middle Western Canada. Since its inception it has been intimately associated with the Winnipeg General Hospital, its professors supplying the main body of the visiting staff. From its size, therefore, from the large area from which its patients are drawn, from the considerable period over which its records extend, from its intimate relation to a centre of medical education assuring the accuracy and com-

* Read before the American Public Health Association at Winnipeg, August, 1908

pleteness of its records, from its unique position in the largest city in Western Canada, where for many years typhoid fever has been endemic, it may, I think, be legitimately inferred that the records of the General Hospital at Winnipeg should supply material of peculiar value in elucidating the characteristics of typhoid fever in the Middle West.

Early in May of the present year, Dr. Stewart (late of the Hospital interne staff), together with the writer undertook to make a statistical study of all classes of typhoid admitted into the hospital wards since 1882. The records, which consist of the Hospital registers since 1882, temperature charts since 1897, and case reports since 1898, are voluminous, and their analysis is still incomplete. The data to be obtained from the registers, however, have been secured and tabulated for all cases, and 1092 case reports have been inspected and analyzed.

An attempt was made to exclude all doubtful cases, and for various reasons, mainly on account of short stay in the hospital, or lack of important data, about 200 cases have been excluded. There still remain, however, 4,605 cases of which the diagnosis can scarcely be impugned. Based entirely upon the results obtained with respect to these cases, the following facts as to the characteristics of typhoid fever in Western Canada are submitted. It will be seen that reference is made almost entirely to incidence and fatality, it being considered that these phases of the disease are most interesting to the members of the Public Health Association.

The incidence of this disease has been investigated with respect to Sex, Age, Nationality, Season and length of time resident in the country.

Sex: Out of 4,605 cases, 3,530 were males, and 1,075 females. A proportion of somewhat more than three males to one female. During the years, 1882 to 1885, the proportion was seven males to one female. Since then the proportion for any one half decade has been very nearly three to one.

That this ratio is not due entirely to the greater preponderance of males in the Westrn population is shown by the fact that in the census report of Manitoba for 1881, the ratio of males to females is less than seven to five, and in 1901, less than seven to six. That it is not due to a greater susceptibility on the part of the male is indicated by the fact that in children, where exposure to the disease may be assumed to be equal in the two sexs, the incidence is very nearly as one to one. (Out of 407 cases in children of 15 years and under 215 were males and 192 females). That it is due entirely to the greater exposure to the disease on the part of the male seems probable.

In the first ten years of life the ratio of males to females is less than one to one. In the second decade about two to one, in the third decade nearly five to one, in the fourth, three to one and in the fifth, two to one.

Age: Of 4,605 cases of both sexes, the average age is 25.5 years, of the males 26.7 years and females 21.5 years. In spite of the great variation in the population of Winnipeg during the last twenty-five years the average age of typhoid cases has been very constant. The average age of 1,130 patients admitted during the 14 years, 1882-1895 is 25.1 years and of 3,475 cases admitted during the 12 years, 1896-1907, the average age is 25.6 years.

Nationality: In the absence of accurate data as to the population of Manitoba according to nationality, an attempt has been made to compare the number of typhoid cases for each nationality with the total admissions for that nationality. Thus, out of one hundred Swedes and Norwegians admitted for all diseases, twenty-three were admitted for typhoid; out of one hundred native Manitobans admitted for all diseases only seven were admitted for typhoid. Other nationalities, on the same basis of comparison give the following figures: Galicia, 19; Austria, 17; Poland, 14; England, 13; Germany, 12; Scotland, 12; Eastern Canada, 11.5; Iceland, 11; Ireland, 11; Russia, 8.5; United States 8.

Season: The month in which the greatest number of typhoid fever cases develop in Manitoba is undoubtedly September. Of all cases admitted in any one year approximately one-fourth are recorded in that month. If the number of admissions for this disease is plotted for any year or period of years it will be seen that the incidence of typhoid reaches its acme in September, falls sharply during November and then more gradually to its minimum in May. That this peculiar seasonal distribution of cases is not due to any local cause was shown in this series by plotting the dates of admissions of eight hundred and twenty-nine cases treated, during a period of twenty-six years at the Winnipeg General Hospital, but resident at points outside of Winnipeg. These cases came from points scattered over a wide area extending from Kenora and Rainy River on the East, to Moosejaw on the West, and from Saskatoon and Swan River in the North, to North Dakota and Minnesota in the South. The monthly incidence in these cases was observed to correspond very strikingly with the totals in which city cases preponderate.

Length of time in the country: It is a matter of common observation in the West that typhoid is very prevalent amongst recent arrivals. Out of 3,170 cases in which the date of arrival in the province is recorded, 965 or 30 per cent. arrived in the same year as that in which they contracted typhoid, 1,543 or 49 per cent. have been in the province less than two years.

General course of disease: The course and symptoms of this disease do not differ materially from what is already familiar in the East. The typhoid fever patient enters the hospital on an average on the ninth day after the onset of symptoms. The temperature has then in 50 per cent. of cases already reached its maximum. The average of the maximum of 779 cases is 103.8° F. In mild cases which include not less than 13 per cent. of all cases, the temperature now gradually falls to the normal line, reaching it on about

the twentieth day after the onset of symptoms. In cases of moderate severity, which include 53 per cent. of all cases, the temperature remains elevated for a period of eight or nine days, then gradually falls to reach the normal on the twenty-fifth day after the onset. In severe cases which constitute about 34 per cent. of the total, in those which recover the fastigium, is followed by a period about seven days in length, in which marked oscillations of temperature occur, variations of from 106 degrees to 94 degrees in thirty hours, with recovery, being recorded in an extreme case. The temperature now declines gradually towards the normal, reaching it on the thirty-fifth day after the onset. The average duration of fever in 628 cases of all classes was found to be 28.3 days. The average length of stay in the hospital for all cases of both sexes is 37.8 days. The female remains in the hospital, on the average, one day longer than the male.

Complications may add to the length of stay in the hospital considerably. Of forty-five cases in which Phlebitis occurred the average stay in the hospital was fifty-two days. Of fifty-six cases of hemorrhage, fifty days; and of forty-seven cases in which Otitis Media was the only complication, forty-six days.

In connection with the complications recorded in this series of cases, the great frequency of Otitis Media is noteworthy. It is also to be noted that the average age in this complication is below the general average while in heamorrhage and nephritis and the other more serious complications it is distinctly above the general average.

Dr. D. A. Stewart has worked out some important data with reference to 573 fatal cases occurring during twenty-six years. His results are as follows:

In the twenty-six years covered by this report, out of a total of 4,605 cases, 573 ended fatally, a death rate of 12.4. In the earlier years of the hospital, the mortality was very high, reaching 28.3 per cent. for sixty cases in 1884, although

in 1892, it reached the lowest point recorded, 5 per cent. for eighty cases. On the whole it has decreased steadily, and for the past three years the death rate has been 10.8 per cent. The most marked lowering of death rate is from 24 per cent. in 1885, and the four preceding years to 14 per cent. in the four years following 1885. It is significant that this fall of 10 per cent. coincides roughly with the occupation of a new hospital building and consequent better organization, and also with the establishment of a Training School for Nurses.

Sex: This series of cases show a difference in mortality between males and females and while ten cases out of every thirty-two of the total 4,605 were males, ten out of forty fatal cases females. That is, the mortality among males was 12.7 per cent., and among females 11.4 per cent. or 1.3 per cent. less.

Age: Age was found to have a distinct bearing upon mortality. From a death rate of 8.9 per cent. in cases under ten years of age there is a steady rise to 17.6 per cent. in cases above forty years. More in detail the particulars are:

First decade	8.9 per cent.
Second decade	10.7 per cent.
Third decade	11.45 per cent.
Fourth decade	13.53 per cent.
Forty years and over	17.6 per cent.

In another paragraph of this paper it has been shown that liability to the more fatal complications increases as age advances, an observation which may, partially at least, account for a steady rise of death rate with the advance of years.

Nationality: Nationality and race seem not only to affect susceptibility to typhoid infection, but also to bear distinct relations to the severity of the attack. The people who take typhoid most readily, however, are not the ones in whom the death rate is highest. Swedes and Norwegians lead in susceptibility, but Scotland heads the mortality list, followed by Iceland, Poland, England, Germany, Western Canada, Ire-

land, Sweden, United States, Austria, Galicia and Russia, and lowest in the order of mortality, as in the order of susceptibility are the native born of the Province of Manitoba. It is significant that people of the same stock and of similar ways of living, such as Austrians, Galicians and Russians fall into groups with regard to both susceptibility and death rate.

Death rate by months: One of the most striking relations developed in a study of the fatal cases is that between mortality rate and in the seasons of the year. The mortality is high in the Winter and Spring months in which the number of cases is small, and very much lower than the general average in the Summer and Autumn months, July, August, September and October. This is rendered more striking by the fact that in this series a number of light cases reported in the Fall months at the height of epidemics which would tend to accentuate this contrast, were thrown out as of doubtful diagnosis. It may pretty safely be concluded, therefore, that the low death rate for these four months is a real phenomenon.

Time of residence: The remarkable incidence among new comers to a community in which typhoid fever is endemic is parallelled almost exactly by the death rate, the rate being very slightly higher. Among all cases in this series in which the time of arrival is recorded, 30 per cent. were in their first year in the province, and 49 per cent. in the province less than two years, while among fatal cases 33.7 per cent. were in their first year and 51 per cent. in the province less than two years.

In the average of a considerable number of cases, patients came to the hospital for treatment about the end of the first week of the disease. Counting this as the first week, it will be found that death in 573 cases occurred as follows:

Second week of disease	20.6 per cent.
Third week of disease	34.7 per cent.
Fourth week of disease	20.1 per-cent.
Later than the fourth week	24.6 per cent.

The greatest number of deaths occurred on the eighth day in the hospital or about the end of the second week of the disease.

THE DIFFERENTIATION OF OUTBREAKS OF TYPHOID FEVER DUE TO WATER, MILK, FLIES AND CONTACT*

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Gentlemen: When I received the invitation from our Honorable President, Dr. Lewis, to read a paper before this association on the differentiation of Typhoid Fever outbreaks due to infected water, milk, etc., I fully realized my limitations in dealing with the subject. However, I thought that a few observations I had made while investigating in my official capacity several epidemics of Typhoid Fever might be of some interest and perhaps profit to you.

It is a serious reflection upon the people of the United States that, according to the census report for 1900, there were 35,379 deaths in the United States that year from Typhoid Fever—a preventable disease. This loss of life, according to Whipple's calculation, represented money loss to the community of $212,000,000 for that year alone.

The average Typhoid death rate in cities of the United States is about 35 per 100,000. Whipple states that in the cities about 40 per cent. of the Typhoid Fever is due to water, 25 per cent. to milk, 30 per cent. to contagion—including fly-transmission, and only about 5 per cent. to all other causes. The Board of Officers of the Public Health and Marine Hospital Service investigating Typhoid Fever in the District of Columbia found in 1906, that of the cases studied by them about 11 per cent. were indefinitely attributed to

* Read before the American Public Health Association at Winnipeg, August, 1908

milk infection, about 7 per cent. to infection by contact; in 1907, they definitely attributed about 9 per cent. to milk and about 19 per cent. to contact.

In the study of an outbreak of Typhoid Fever it is of vital importance, first of all, to determine whether the disease is really Typhoid Fever. For this purpose, in addition to the usual bedside methods, two other procedures may and should be employed in all doubtful cases. I refer to the Widal reaction and to blood cultures. The blood culture is of more value than the Widal test in that cultures can be obtained in the first days of the disease. For the examination of the blood we have found the bile enrichment method, followed by plating on Endo medium, the most satisfactory. By this method, cultures taken in the first week of the disease will give positive results in 90 to 100 per cent. of the cases.

Having determined that the disease prevailing with undue frequency is typhoid fever it is necessary that each case be studied in detail from an epidemiological standpoint. In places which require the reporting of Typhoid Fever, the study is much easier than in those where it is not done. The essential data can only be obtained by competent persons visiting the patients and obtaining all possible information from the patient, nurse and family, and by an inspection of the premises.

It is well to have a map of the city and, as the data for each case are collected, to indicate the location on the map by sticking in a large pin. A glance at this will readily show if the cases are confined to any particular locality.

All data collected should be at once tabulated and carefully studied as to the bearing of the various probable sources of infection.

I shall now take up in detail the special characteristics of outbreaks of Typhoid Fever due to infected water and milk, and to transmission by flies, etc.

CHARACTERISTICS OF OUTBREAKS DUE TO WATER.

The striking characteristics of outbreaks of Typhoid Fever due to water are:

1. *General distribution of cases throughout the area supplied by a particular water.*

The incidence of cases is independent of social conditions, occupation and age, except that very young children as a rule are not affected in equal proportion to other ages, due, perhaps to the difference in susceptibility and to taking less water.

2. *Explosive onset of the outbreaks.*

When the water supply previously good becomes suddenly infected, as in the case of Plymouth or Butler, Pa., the outbreak begins with great suddenness and violence. There is a sudden and great increase in the number of cases reported; this increase may continue until the sources of infection of the water are removed or the water supply changed. If the former be the case there is a more gradual decline in the number of cases than when the supply is suddenly replaced by a pure one, in which case the decrease is sudden and marked. Secondary cases from contacts may keep the number above normal for a time.

When there is a continuance of the source of the infection, as in the case of the Lowell and Lawrence outbreaks of 1890 and 1892, the onset is not usually so explosive in character and the decline is more gradual. In Pittsburg, where there is a continual infection of the water supply, the disease is more prevalent in the Fall and Winter, which may be due in part to other causes than water.

When a water supply, such as a river, is subject to continual infection the increase in the number of cases in late Summer and Fall may be attributed to the fact that, as the number of cases increase which supply infection for the stream, the amount of infection is correspondingly increased.

3. *Seasonal prevalence; Spring or late Winter.*

Outbreaks of Typhoid due to infection of a water supply previously good usually occur in the late Winter or Spring. This is due, as in the case of the Plymouth and New Haven epidemics, to the fact that infected discharges are thrown on the frozen ground and when thaws or floods come the infection is suddenly washed into the stream.

When a supply becomes infected by the failure of the purification methods used or by a change in the source, the outbreak is, of course, independent of season.

4. *Comparative freedom from the disease of persons not using the suspected water.*

When there is more than one water supply or where persons use pure bottled water or boil the water, the comparative freedom of such persons from the disease is striking. This was well shown in the Butler epidemic, where a large part of the first ward of the city received their water from deep driven wells; in this ward, with an equal population to the other four wards, there were only about one half as many cases.

5. *Inspection of the water shed shows evident sources of infection.*

An inspection of the water shed may show that it is being continuously infected by discharges of Typhoid Fever cases. In some cases, as at Butler and other places, the discharges may actually have been allowed to go directly into the stream from privies overhanging it.

6. *The outbreaks may have begun or ended, following a change of the water supply.*

When a previously good water is replaced for any good reason by an unknown water or a suspected water is replaced by one of undoubted purity, the consequent beginning or discontinuance, as the case may be, of an outbreak of Typhoid would properly be laid to water.

7. Bacteriological and chemical examination reveals evidences of pollution.

While it is practically hopeless to expect to find the typhoid bacillus in water, still the finding of *B. coli* in small amounts of water and chemical evidences of pollution are additional evidence against the water.

8. *Exclusion of all other probable causes.*

This means the exclusion of milk, food, contact, fly transmission, and other possible sources of infection.

OUTBREAKS DUE TO MILK.

On investigating an outbreak of Typhoid Fever, the following points would indicate very strongly that the infection was being introduced through the milk.

1. Sudden outbreak of an unusual number of cases followed by a rapid decline.

The outbreak is frequently sudden in its onset; a large number of cases occurring on a certain milk route within a few days. If the infection be introduced only once, as by flies, there is a sudden rise followed by a sudden decline in the number of cases. If there is a continuance of the infection, as from a bacillus-carrier, the onset may be more gradual and the decline will be delayed.

In dairies which do not practice sterilization of bottles, the milk may become infected through bottles delivered at houses where there are cases of Typhoid Fever; these infected bottles are returned to the dairy, refilled, and delivered to other customers. Where the milk becomes infected by washing the cans with infected water, as in the Palo Alto outbreak, the number of cases is usually much greater than when infected in other ways. After the usual incubation period secondary cases from contacts begin to appear.

2. The appearance of an unusual number of cases among customers of a certain dairy.

The appearance of an unusual number of cases without a general increase elsewhere on the route of a dairy should at once direct especial attention to the milk. Of course Typhoid Fever due to infection from other sources may occur among persons supplied by a particular dairy, but they will not be found to be chiefly consumers of the milk. It is often very striking how the consumers of a dairy whose milk is infected may be picked out by the unusual proportion of cases on that milk route. Very frequently cases may be traced in persons not directly supplied by the suspected dairy, but who have taken this milk at the home of some friend or at a restaurant. An increase in the number of cases on a certain route associated with a decrease generally throughout the city is particularly suggestive of milk infection.

3. Unusual incidence of cases among users of milk.

It will be found that there is unusual prevalence of Typhoid Fever among the users of milk; the non-consumers escape or develop as secondary cases. As women and children generally use more milk than men an unusual prevalence of the disease among them is a common feature of milk-borne outbreaks. Those families on the suspected route who make a practice of pasteurizing their milk escape, except from infection as secondary cases.

4. More cases among the well-to-do than among the poor.

In a milk outbreak there are usually more cases among the well-off, due to the fact that they are more able to buy milk and use it in larger quantities than the poor, while in fly-borne outbreaks the poor and those living under insanitary conditions are more often attacked.

5. The finding of the typhoid bacillus in the suspected milk.

This is practically hopeless, as the milk rarely comes under suspicion for at least three weeks after having

become infected. In addition, the technical difficulties are so great that it is an almost hopeless procedure, though the isolation of the organism should be attempted. If successful, it is absolutely conclusive.

CHARACTERISTICS OF THE OUTBREAKS DUE TO CONTAGION AND TRANSMISSION BY FLIES.

It is impossible to state definitely the characteristics of outbreaks of Typhoid Fever due to transmission by flies and to contacts as in the case of milk and water outbreaks. A final conclusion in regard to the source of the infection can only be reached by a consideration of all the factors involved.

For purposes of convenience I shall discuss the characteristics of outbreaks of Typhoid Fever due to contagion and transmission by flies at the same time. The great part played by flies in the transmission of Typhoid Fever was first emphasized in the masterly Report of the Origin and Spread of Typhoid Fever in United States Military Camps during the Spanish War by Reed, Vaughan and Shakespeare. They concluded that "flies were undoubtedly the most active agents in the spread of Typhoid Fever. Flies alternately visited and fed on the infected fecal matter and the food in the mess tents. More than once it happened when lime had been scattered over the fecal matter in the pits, flies with their feet covered with lime were seen walking over the food. Typhoid Fever was much less frequent among members of messes who had their mess tents screened than it was among those who took no such precaution. Typhoid Fever gradually died out in the Fall of 1898, in the camp at Knoxville and Mead with the disappearance of the fly, and this occurred at a time of year when in civil practice Typhoid Fever is

generally on the increase. The first pits at Knoxville contained, before the first twenty-four hours had passed after the arrival of the troops, fecal matter infected with the Typhoid bacillus. Flies swarmed everywhere. Instead of abating, the disease increased. The soldiers were using the same water used exclusively by the inhabitants of West Knoxville, and among the latter there was not at that time a case of Typhoid Fever. Certainly the disease was not disseminated through the drinking water.*

Alice Hamilton† investigated in 1902 an outbreak of Fever in the Nineteenth Ward of the city of Chicago. This ward, which only contained about one thirty-sixth of the total population of the city, had between one-sixth and one-seventh of all the deaths from Typhoid Fever. It seemed to her that, while the water was undoubtedly the causative factor in the epidemic throughout the city, there must be some local cause for its undue prevalence in the Nineteenth Ward. The sanitary arrangements in this ward were found to be very bad and on those streets with the worst sanitary arrangements there were the largest number of deaths from Typhoid Fever, irrespective of the poverty of the inhabitants.

Flies caught in two undrained privies, on the fences of two yards, on the walls of two houses, and in the room of a Typhoid patient, were used to inoculate 18 tubes; from five of these tubes the Typhoid bacillus was isolated. In this outbreak the chain of evidence implicating the fly in the spread of the disease was certainly convincing and almost complete.

The outbreak in the city of Winnipeg, in August, 1904, investigated by Dr. E. O. Jordan, which was confined almost entirely to the poorer part of the city, was attributed to transmission by flies and contacts.

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*† Journ. Am. Med. Ass., vol. 40, 1903, p. 576.

Outbreaks due to direct contact are seen especially in institutions where there are Typhoid Fever cases and in houses where the family and friends visit and assist in the care of the patient. In these cases the infection is conveyed either directly by the future patient or indirectly by the nurse to food consumed by others.

Typhoid-carriers, such as the one reported by Soper in the person of a cook, who was responsible for at least 28 cases of Typhoid Fever in families in whose employ she had been, are instances in which the infection is conveyed by a third person.

The bacilli have been found in practically all of the excretions of Typhoid Fever cases and it is only by the most scrupulous care on the part of the attendant that infection can be avoided for himself and others. The Board of Officers of the Public Health and Marine-Hospital Service, studying Typhoid Fever in the District of Columbia, attributed about 7 per cent. of the cases in 1906, and about 19 per cent. in 1907, to contact infection from other cases.

The chief characteristics, then, of outbreaks of Typhoid Fever due to transmission by flies and by contact are their local character, their appearance in places where the sanitary conditions are poor or where they are neglected, occurring during the fly season in the case of fly-transmission and among those most closely associated with the patient.

TYPHOID BACILLI CARRIERS *

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ABSTRACT.

During the past few years a number of epidemics of typhoid fever, traceable to chronic "typhoid bacilli carriers" have been reported. Although Frosch called attention to the existence of carriers and the responsibility of their transmitting typhoid fever in 1902, and Lentz[15] in 1905, wrote an exhaustive article in which he mentioned a number of cases of typhoid fever traceable to such, the first recognized striking example of the influence of a chronic typhoid bacilli carrier was reported by Kayser[9] of Strassburg, in 1906. In order to condense our subject matter at the same time furnish a basis for making deductions, the essential data of the principal epidemics of typhoid fever traceable to bacilli carriers reported up to this time, are given in the following table. The details of these cases may be obtained by consulting the original articles referred to in the bibliography.

This table (page 261) is very interesting and enables us to formulate certain general conclusions (based on carriers who have transmitted the disease to others):

1—About 75 per cent. of all carriers thus far recorded are women.

2—Almost without exception, the carriers have either been engaged in some occupation as baker, cook or handler of

* Read before the American Public Health Association at Winnipeg, August, 1908

Reported by	When case Reported.	Place of Occurrence.	Number of Carriers Reported.	Sex.	Occupation.	Carrier had Typhoid Fever in	Carrier never had Typhoid Fever.	Carrier transmitted Typhoid Fever to number of people	Typhoid bacilli isolated from	
									Feces.	Urine.
Kayser	1906	Germany	1	Female	Baker	1896		Quite a large number	+	
Kayser	1906	Germany	1	Female	Milk trade			17		
Neiter & Leifmann	1906	Germany	11	Females	Inmates Insane Asylum		+	Number of cases		
Neiter	1907	Germany	13	Females	Inmates insane asylum			Number of cases	+ from all	
Kossel	1907	Germany	1	Male	Milker dairy		+	Number of cases	+	
Soper	1907	U.S., N.Y.	1	Female	Cook			26	+	
Levy & Kayser	1907	Germany	1	Female	Inmate insane asyl'm	1904		Number of cases		
Dehler	1907	Germany	2	Females	Inmate insane asyl'm			Number of cases	+	
Southworth	1907	U.S., N.Y.	1		Child, 16 mos. old	1907		4		
Albert & Gunn	1907	U.S., Ia.	1	Male	Kept cow and distributed milk	1906		13		+
Ledingham	1908	Scotland	3	Females	Inmate insane asyl'm			Number of cases	+	
Scheller	1908	Germany	1	Female	Milker in dairy	1891		32	+	+
Scheller	1908	Germany	18		Obtained milk from same dairy			13	+(10)	(10) +
Dean	1908	England	1	Male	Physician	1879			+	+
Gregg	1908	U.S., Mass	1	Female	Keeper of boarding house	1856		7	+	

milk, which has enabled them to transmit typhoid bacilli to substances used as food by others, or who, such as children, or inmates of insane asylums, are careless about their personal habits.

3—Carriers have in some instances had typhoid fever but a short time previous, in others as long as 10, 30 and even 52 years.

So far as present methods of examination have enabled us to determine, the bacilli, in the majority of cases of typhoid fever disappear within 8-10 weeks after the beginning of the disease. It has therefore been suggested that we consider as "chronic carriers" all who still carry the bacilli 10 weeks after the beginning of the disease or in case of a recurrence, from the beginning of such.

Klinger[12] examined the feces of 428 cases of typhoid fever, and found that 8 or 1.7 per cent. of them continued to harbor the specific bacilli longer than six weeks after the temperature had become normal. Kayser[11] found that three of 101 persons who had typhoid fever in 1903, 1904, and 1905 still discharged typhoid bacilli with their feces in 1906. Others have found that as high as 5 per cent. of the cases of typhoid fever become chronic carriers. Carriers who have never had typhoid fever are fairly numerous. These cases, which Lentz refers to as "symptomless typhoids" do not readily contract the disease, partly because the body has gradually become immunized. It has been estimated that probably 1 in every 500 adults who have never had typhoid fever is a chronic carrier. Fortunately, however, the majority of them do not carry the bacilli very long. They have therefore been referred to as "acute carriers" as distinguished from "chronic carriers." It is impossible at this time to state just how long on an average, the bacilli carriers remain as such. Considering, however, the various figures obtainable at the present time, it has been estimated that there are about one-half as many typhoid-bacilli carriers as there are number

of cases of typhoid fever in a given community in one year.

To illustrate the part they played in the spread of typhoid fever, it may be mentioned that of 386 cases of typhoid fever in one sanitary district in Germany, 20 per cent. were traced to "chronic carriers." So far as we know the bacilli leave the body of chronic carriers somewhat more often in the feces than in the urine. Often they occur in the urine, even if they cannot be found in the feces. Both should therefore always be investigated. It is of importance to note that typhoid bacilli may usually be found in much larger numbers in the feces or urine of the chronic carriers than of typhoid fever patients. So far as our present knowledge goes, the gall bladder is the principal organ in which the typhoid bacilli of chronic carriers develop and from which they constantly pass into the intestinal canal.

This then is a great problem. It opens up an important phase of the epidemiology of typhoid fever. A due consideration of this phase of the subject will, I am sure, clear up the source of many cases and epidemics of this disease which cannot be well explained by the ordinary well-recognized modes of infection and which have hitherto been so puzzling. Whenever there are household epidemics or a series of outbreaks of the disease in a locality or an institution or among soldiers in the field we should consider that a "bacilli carrier" is the most probable source. If an individual has an attack of cholecystitis or biliary colic soon after an attack of typhoid fever, we should suspect that such has been caused by typhoid bacilli and that such a person is a typhoid bacilli carrier. Our knowledge of this phase of the subject is already sufficiently definite to warrant the consideration of special methods of preventing typhoid fever patients from becoming typhoid bacilli carriers, and typhoid bacilli carriers from giving the disease to others. As a remedial measure applicable at the present time may be mentioned:

1—The administration of hexamethylenamin, in sufficiently large doses gives antiseptic properties to both the urine and the bile. Richardson[22] has recommended the giving of hexamethylenamin as a prophylactic to all typhoid fever patients in doses of 30 grains a day for ten days, beginning with the third or fourth week of the disease. Crowe[1] has recently shown that when given in doses of 75 grs. per day, it has a distinct influence in ridding the gall-bladder of contained bacilli. Whether, when given in such doses, it can be depended upon to rid all or even most of the chronic carriers of typhoid bacilli remains to be determined.

2—The feces and urine of typhoid fever patients should be disinfected for at least six weeks after the patient has entirely recovered from the disease, just as during the period of illness, especially if they are liable to contaminate substances used for human consumption.

3—The prohibition of persons known to be typhoid bacilli carriers from engaging in any such occupation as cooking, baking, dairy work, etc., which may from the articles handled endanger the lives of others. This prohibition may well apply to all who have had typhoid fever until by repeated examinations, no typhoid bacilli can be demonstrated. If such precautions cannot be observed, it is exceedingly important that such persons should be carefully instructed as to personal cleanliness.

4—The isolation of chronic bacilli carriers in insane asylums and similar institutions.

5—Our public water and milk supplies should be more carefully protected and placed under proper municipal control.

As measures which may become applicable at some future time may be mentioned:

1st—Routine bacteriological examination of the feces and urine of convalescing or convalescent typhoid fever

patients to determine the presence or absence of typhoid bacilli as a condition for release from quarantine, just as is now done in connection with diphtheria. This would apply not only to the typhoid fever patients, but to those who have taken care of such patients or in any way been exposed to infection. Ledingham[14] suggests examinations of the excreta of all who have had typhoid fever once a month for a period of at least six months.

2nd—Operation in the nature of a cholecystotomy and drainage of the gall-bladder or complete removal of the gall-bladder. Such seems especially applicable for inmates of insane asylums. (See Dehler[3] and Grimme[7]).

3rd—Vaccine therapy. If vaccination against typhoid fever proves as efficient as some of our statistics lead us to believe, it is not at all improbable that at no distant day we shall be vaccinating against typhoid fever, just as we now vaccinate against small-pox, wherever the disease is endemic or whenever it becomes epidemic.

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INVESTIGATION OF TYPHOID FEVER EPIDEMIC AT SHEBOYGAN, WISCONSIN *

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An epidemic of Typhoid Fever started at Sheboygan, Wisconsin, during the last of January, 1908, and continued until June, 1908. The Wisconsin State Hygienic Laboratory was called to investigate the situation, and went up and endeavored to discover the cause of the large number of cases of Typhoid Fever.

Sheboygan is a very beautiful little city of about 27,000 or 28,000 inhabitants. Being located on Lake Michigan at the mouth of the Sheboygan river, it occupies a most advantageous position among Wisconsin cities.

The nationality of the city consists of about 80 per cent. Germans, some Poles, Armenians, Greeks and Jews, and the rest Americans.

GENERAL DEATH RATE.

Oct. 1, 1905 to Sept. 30, 1906 ..	13.4	per 1,000 inhabitants.
Oct. 1, 1906 to Sept. 30, 1907 ..	13.5	per 1,000 inhabitants.
Oct., 1907	15.7	per 1,000 inhabitants.
Nov. 1, 1907	16.0	per 1,000 inhabitants.
Dec. 1, 1907	11.3	per 1,000 inhabitants.
Jan. 1, 1908	15.1	per 1,000 inhabitants.
Feb. 1, 1908	16.9	per 1,000 inhabitants.
Mar. 1, 1908	18.9	per 1,000 inhabitants.
Apr. 1, 1908	18.4	per 1,000 inhabitants.

* Read before the American Public Health Association at Winnipeg, August, 1908

DEATH RATE BY INTESTINAL TROUBLES.

Oct. 1, 1905 to Sept. 30, 1907 ..... 62 deaths.

DEATH RATE BY TYPHOID FEVER.

Jan. 1, 1908 ..... 1 death.
Feb. 2, 1908 to Mar. 4, 1908 ..... 7 deaths.
May 2, 1908 to June ..... 2 deaths.

During the seven months from October 1, 1907, to April 30, 1908, 6 per cent. of the deaths were from Typhoid Fever. The general death rate is abnormally high. December is the only month that had a lowering of the death rate, and it ran a little below normal, figuring twelve per thousand as normal. This death rate is especially high too, since the census of 1905 was not used, but an estimated census of 1908. Had the census of 1905 been a basis for estimation, the death rate would have been a great deal higher.

NUMBER OF CASES OF TYPHOID FEVER.

May, 1906 ..... 30 cases.
Dec., 1906 ..... 5 cases and 1 death.
1907 ..... 70 cases and 10 deaths.

Most of the cases of 1907 were in the early Spring, March having 26 cases and 4 deaths. Among these cases 17 were in very bad hygienic surroundings, 7 or 8 were cases contracted out of town, 3 cases were from well water, and the source of the remainer was not able to be found.

Jan. 1908 ..... 8 cases.
Feb. 1908 ..... 12 cases.
Mar. 1908 ..... 22 cases.
Apr. 1908 ..... 32 cases.
May, 1908 ..... 26 cases.

During the first five months there was a great increase in the number of cases of deaths, the greatest number occurring in March and April.

In understanding the water supply of Sheboygan one must also have a knowledge of the sewer system. The

sewer system consists of a combination storm and sanitary sewer flowing by gravity in the Sheboygan river and then into Lake Michigan. Four sewers empty immediately into Lake Michigan and seventeeen empty into the Sheboygan river. There is a great number of factories along the river and emptying their sewage into it. These factories are twenty-six in number and besides dumping the refuse from the factories, the waste from the people there employed also goes into the river. Among these factories are tanneries, rendering plants, dye works, breweries, glove factories, chair factories, and glue works. Besides these factories there are two cemeteries situated on the banks of the river west of the city. One can see from this description what an enormous amount of sewage is being poured into the river and finally into Lake Michigan.

The Michigan Avenue sewer is only about three-quarters of a mile from the intake pipe of the water supply, then next to this is the Niagara Street sewer.

*The Sheboygan water works are owned by the American Water Works Company and their supply obtained from Lake Michigan, being pumped from a standpipe, the capacity of which is 329,000 gallons. It is made of iron 20x140, and its pumping capacity is 15,000,000 gallons per day. The pipe line into the lake consists of bell and spigot cast iron pipe laid in a dredged trench four to nine feet deep. Then the intake is weighted with rocks and the timber crib protected by a screen over the open ends of the pipe which extends into the lake 1,800 feet from shore. There is an emergency intake laid 900 feet from shore. The end of this pipe is also protected by a screen.

The standpipe was emptied and the sediment in the bottom examined and found to be high in bacteria, which was no more than we expected. The bacteria were gas-producing, and some resembled the colon bacillus.

* Now owned by city of Sheboygan.

We then collected samples at several different times and at various places over the lake, starting near the shore and working out along the intake pipe and also two to two and a half miles beyond. Samples were also collected north of the intake on account of the Pigeon river emptying there, and some pollution of the lake was found from that source. Then we collected samples from the intake in Lake Michigan to the mouth of the Sheboygan river. Between the intake and the mouth of the river is a point and ledge of rock extending about 600 feet out into the lake which does offer some protection to the intake by keeping back the polluted water. The results of the analysis are shown in the accompanying table.

From the results of the analysis we can condemn the water, drawing our conclusion from the varying amounts of chlorine, ammonia, nitrates and nitrites, also from the bacterial content, colon being found quite frequently and gas-forming organisms being present all the time.

In regard to the winds over Lake Michigan would say that commencing with February there is generally a pretty strong south-east wind blowing over the lake. This lasts until September or October, then we have a strong west and north-west wind. There seems to be more or less intestinal trouble during the Summer months. The results of our investigations all point to the fact that sewage could be blown back to the mouth of the intake.

The United States Engineering Corps says that there is a general tendency toward a southern current on the west shore of Lake Michigan. They have estimated that during storms on Lake Michigan waves have stirred up the waters to a depth of as low as 45 to 50 feet, but at 60 feet there seems to be no action.

Thus in summing up the results of our investigation, we found that the water in Lake Michigan off the shore of Sheboygan was polluted for a mile to a mile and a half out.

We thought best to recommend a filter plant rather than the extension of the intake. If the intake was extended, it possibly would be only a short time until the pollution would increase and the intake would again have to be extended.

INVESTIGATION OF WATER SUPPLY OF SHEBOYGAN, WISCONSIN. BACTERIOLOGICAL ANALYSIS

Date, 1908	Bacteria per cc.	Acid colonies per cc.	Colon Bacilli	Gas-producing Bacilli
Feb. 3	50	10	—	40-42%
Feb. 3	50	—	—	Growth
Feb. 19	140	45	+	+
Feb. 19	350	8	+	+
Feb. 24	270	4	—	Growth
Mar. 2	40	—	—	"
Mar. 19	160	20	?	"
Mar. 23	270	10	—	"
Mar. 23	280	10	—	"
Apr. 20	180	40	+	"
Apr. 20	180	75	?	"
Apr. 20	180	29	?	"
Apr. 20	180	5	?	"
Apr. 20	170	5	+	"
May 14	—	10	—	"
May 14		18	—	"
May 14		20	—	"
May 14		0	—	"
May 14		0	—	"
May 14		0	—	"

INVESTIGATION OF WATER SUPPLY OF SHEBOYGAN, WISCONSIN

Date 1908	Specific Location	Turbidity	Color	Odor	Total Hardness	Residue on Evaporation	Loss on Ignition	Chlorine	Oxygen Consumed	Free Ammonia	Alb Ammonia	Nitrites	Nitrates
Feb. 3	Tap	350	Milky	Earthy	185.3	209.1	90.8	10.0	1.5	0.015	0.09	1.0	—
Feb. 3	Well at Pumping Station	200	Clear	Earthy	183.0	130.0	100.0	10.0	2.0	0.02	0.09	0.5	—
Feb. 12	Intake well	600	Milky	Earthy	185.0	140.0	80.0	12.0	2.0	0.044	0.125	0.20	—
Feb. 12	8th St. Hydrant	600	Yellowish	Earthy	182.0	184.0	60.0	13.0	2.0	0.015	0.7	0.025	—
Feb. 24	Intake well	600	Milky	Earthy	180.1	130.0	30.0	9.0	1.5	0.03	0.115	Trace	—
Mar. 2	Tap	550	Milky	Earthy	181.19	199.2	75.8	10.0	1.824	0.03	0.111	"	—
Mar. 12	Intake well	450	0	Earthy	180.0	190.3	65.0	9.5	1.8	0.02	0.10	"	—
Mar. 23	Intake well	400	0	0	182.0	195.01	74.3	14.0	2.0	0.08	0.11	"	—
Mar. 23	Tap water	300			182.5	188.2	75.0	11.0	1.5	0.05	0.07	"	—
Apr. 20	Intake well	300			188.4	206.1	80.4	10.0	1.5	0.04	0.08	"	—
Apr. 20	Inside reef 15ft. deep	400	Slightly Green	Musty	188.2	119.2	71.2	12.0	2.184	0.05	0.205	"	—
Apr. 20	1 mile out 28ft. deep	200		Musty	178.2	122.4	81.6	10.0	2.552	0.005	0.14	"	—
Apr. 20	1 mile out 50ft. deep	30			182.4	140.0	71.6	16.0	1.5	0.08	0.18	"	+++
Apr. 20	1¼ mile out, 55ft. deep	30			180.5	126.4	50.2	8.0	0.5	0.015	0.14	"	—
May 14	Break in intake	500	Dirty	Musty	180.2			13.0		0.065	0.097	—	—
May 14	End of intake	400	Dirty	Musty				12.0		0.001	0.15	—	—
May 14	1 mile out 40ft. deep	100	—	—				10.0		0.0125	0.148	—	—
May 14	1¼ mile out, 45ft. deep	30						10.0		0.0075	0.065	—	—
May 14	2 miles out 55ft. deep	10						8.0		0.0004	0.001	—	—
May 14	2½ miles out, 75ft. deep	10						7.0		0.0025	0.005	—	—

MORBIDITY AND MORTALITY STATISTICS OF TYPHOID FEVER IN THE MIDDLE WEST *

By Dr. C. A. HARPER
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In collecting morbidity statistics for Typhoid Fever in the Middle West it is found impossible to obtain reliable data. Therefore, as far as morbidity statistics are concerned in this paper, the lack of completeness in these reports will be more strongly exemplified than any other feature. I have endeavored, however, to classify them upon a basis usually adopted in the estimating of Typhoid mortality statistics.

It is found also that while the mortality reports are much more accurate than the morbidity reports, yet there are variations as to the completeness of this feature.

No reliable data could be obtained for the State of Iowa for the years 1900, 1901, and 1902. In Illinois negative application had to be made for the years 1900 and 1901. Minnesota, Ohio, Indiana and Michigan have tabulated their Typhoid statistics even prior to these dates.

With an aggregate population in Minnesota, Iowa, Wisconsin, Illinois, Indiana, Ohio, and Michigan of 20,000,000 I find that the average mortality rate is twenty-six per 100,000 population. Considering the total number of deaths from Typhoid Fever reported each year in the Middle West I find that there has been a steady decline in the number of deaths reported, from 5711 in 1900 to 4707 in 1907. Since 1900 the reports of all deaths have been much more accurate in all of the States included in the investigation, with the possible ex-

* Read before the American Public Health Association at Winnipeg, August, 1908

ception of Illinois. That there should be such a decline in the number of deaths reported in spite of the greater accuracy is reliable assurance that the mortality from Typhoid Fever and also the morbidity from this disease is on the decrease.

DEATHS FROM TYPHOID FEVER IN THE MIDDLE WEST

STATE	Deaths from Typhoid Fever by years								Total deaths	Average deaths per year	Death rate per 100,000 population	Estimated no. of cases per year
	1900	1901	1902	1903	1904	1905	1906	1907				
Minnesota	351	377	311	271	251	289	285	308	2721	340	19	3400
Iowa				171	209	295	77	248	1000	200	89	2000
Wisconsin	178	256	153	275	264	328	261	287	2080	260	13	2600
Illinois			1882	1578	1200	1047	1061	1119	7987	1331	27	13330
Indiana	1440	1198	1217	1013	1013	928	915	852	8574	1072	42	10720
Ohio	1291	1143	1253	1548	1521	1253	1238		9247	1321	31	13300
Michigan	920	665	596	640	731	661	698	572	5483	685	28	6900
TOTAL	5711	5150	5612	5594	5369	4801	4731	4707		5209	249	52250

A cursory examination of the Typhoid situation in various sections of the United States tends to show that Typhoid Fever is more prevalent in the Middle West than in other State groups, with the exception of the Southern tier of States. For the census year 1900 the death rate from Typhoid Fever per 100,000 population in the registration States was Connecticut, 27.4; Maine, 28.8; Mass., 23.3; Mich., 28.1; New Hampshire, 16.8; New Jersey, 21.1; New York, 24.4; Rhode Island, 23.8; and Vermont, 31.1, or an average of 24.8.

A camparison of the rates in states of the United States where comparatively accurate returns are received with rates in foreign countries proves conclusively that there is a startling number of deaths from Typhoid Fever in this country. In foreign countries per 100,000 population for the year 1902, England and Wales gave a death rate of 12.6; Scotland, 12.2;

Ireland, 13.8; Norway, 4.6; German Empire, 7; Switzerland, 6.2; Spain, 45.8; and Italy, 34.6, or an average of 17.1 per 100,000 population. In Michigan during the period 1900 to 1904 the nineteen cities having populations ranging from 5000 to 10,000, the average Typhoid mortality was 40.1 per 100,000 population. In the six cities having populations of from 25,000 to 300,000 the average mortality rate for the five years was 23.3 per 100,000. The largest cities therefore show 16.7 per cent. per 100,000 lower mortality than the smaller cities.

In Minnesota where a comparison has been made between death rates in cities and rural districts for twelve years, from 1888 to 1899, the rate in cities over 15,000 was 65 per 100,000 population. In cities from 5 to 15,000 the rate was 40 per 100,000 population, while in towns and cities under 5000 the rate was 20 per 100,000 population.

The rural and urban mortality statistics in the newer States of the Middle West appear to be reversed as compared with the older States in this same group or older States in the Union. This can probably be accounted for in two ways. First: The rapid growing cities in the newer States have not kept up the proper sanitary conditions in proportion to the increase of population. Second: In rural districts sufficient time has not elapsed for the soil to become saturated so as to infect the well water supplies. The individual holdings of the newer States in the Middle West are larger. Therefore personal contact is less frequent and the transmission of the disease by flies or other germ carrying agents is less likely to occur. In forest regions many country cases are sent to city hospitals for treatment.

It is probable that the morbidity and mortality from Typhoid Fever in the smaller cities and villages is due to the use of shallow wells, the water of which is always liable to contamination by leachings, cess pools, privies, and surface filth contained in the sub-soil. There are, however, many localities in Wisconsin, and I presume in other States, where

it is impossible to trace the source of infection to either polluted water or infected milk supplies. In such cases the disease is confined to smaller cities, villages, or densely populated townships, where the common privies are extensively used without any effort being made to exclude the flis.

A locality once infected by a Typhoid Fever epidemic tends to show recurrence of this disease. This has been particularly well exemplified by the city of Port Washington in Wisconsin. Port Washington is a city of 5,000 population. A dairyman who had cases of Typhoid Fever in his family furnished milk to two hundred families, or an estimated population of one thousand individuals. The sale of milk was stopped within a few days from the time of the outbreak after investigation determined the source of infection. Of the one thousand individuals furnished this infected milk 116 cases of Typhoid Fever originated, with fourteen deaths. Before this epidemic Port Washington had been practically free from Typhoid Fever. Since this epidemic Typhoid is found in this city from

DEATHS FROM TYPHOID FEVER IN CERTAIN CITIES IN THE MIDDLE WEST

NAME OF CITY	Deaths from Typhoid Fever								Total deaths	Average deaths per year	Death rate per 100,000 pop.	
	1900	1901	1902	1903	1904	1905	1906	1907				
Minneapolis, Minn.	67	129	64	101	100	56	82	70	669	84	41	
St. Paul, Minn.	84	21	26	18	26	18	45	35	223	28	17	
Duluth, Minn.	49	36	32	38	38	28	33	29	285	35	69	
Burlington, Iowa					14	13	2	3	32	8	34	
Milwaukee, Wis.	59	63	48	54	43	68	98		433	62	22	
Superior, Wis.		45	15	17	12	10	35	9	145	20	84	
Racine, Wis.		7	10	20	8	8	7	8	68	10	34	
Oshkosh, Wis.							9	9	18	9	32	
La Crosse, Wis.			7	8	5	6	9		35	7	25	
Chicago, Ill.		509	801	588	373	329	370	376	3280	470	29	
Canton, Ohio											42	av. 1890-1904
Cincinnati, Ohio											51	
Columbus, Ohio											48	
Detroit, Mich.		71	71	70	70	71			353	70	27	
Grand Rapids, Mich.		39	39	39	39	53			209	42	48	
Jackson, Mich.		8	8	8	8	15			47	9	54	
Kalamazoo, Mich.	9	8	5	11	7	5	13	6	64	8	20	
Sioux Falls, So. Dakota				56	51	84	17	22	160	32	510	

time to time in various localities. The infection carried there in the year 1904 is still having its effect upon the morbidity and mortality from Typhoid.

The seasonal variation of deaths from Typhoid Fever for the fifteen years from 1887 to 1901 show the highest rates from September to November, with a maximum in October. During the months of July and August in the Middle West the ground water is usually very low, which tends to increase the danger of infection and the mortality is the greatest in October following these months. An examination of the mortality and morbidity statistics by months proves conclusively that the seasonal variation of the disease should be carefully considered. During the season when ground water is low Typhoid Fever is usually prevalent. Pettenkofer states that the maximum of the Typhoid mortality curve corresponds to the minimum of the ground water level. When the water in the wells is low the danger of pollution is greatly increased and since it has been definitely shown that water containing Typhoid bacilli may be greatly diluted and even filtered through a large quantity of soil without losing its infective properties I should not be surprised to find that an overwhelming number of the cases and epidemics from Typhoid Fever originated primarily from a polluted private well.

The rural population in the older sections of the country is largely responsible for Typhoid infected water, and in nearly every case is primarily to blame for Typhoid infected milk.

While it is impossible to determine to what extent camping parties returning to the city are responsible for the annual increase in number of cases, yet this is opening up a new field for investigation which goes to show that the heedlessness of campers gives rise to much of the city Typhoid. This fact is also verified by the return of soldiers after a period of encampment. It appears that in the wealthier residential wards of the cities where the inhabitants are accustomed to taking annual camping vacations the recurrence of Typhoid in these localities

is almost constant at certain seasons of the year, while in other portions of the same city Typhoid is more sporadic.

Not a single city of over 500 in the Middle West has as low a death rate from Typhoid Fever as London, where the rate in 1903 was only 8.3 per 100,000 population. This would seem to effectively prove that there is not necessarily any connection between density of population and the mortality from this disease.

CASES OF TYPHOID FEVER IN CERTAIN STATES AND CITIES

STATES.	Cases of Typhoid Fever by years								Total cases	Average No. of cases per year	Cases per 100,000 pop.	Average No. of deaths per year	Mortality rate
	1900	1901	1902	1903	1904	1905	1906	1907					
Michigan	5122	3002	2456	2840	3028	2774			19222	3204	132	685	21%
Indiana						4682	5230	5088	14950	4088	197	1072	21%
Wisconsin	1465	1804	1007	874	895	658	908	724	7335	917	44	260	28%
CITIES													
Minneapolis, Minn.		630	320	720	738	260	252	181	3110	444	218	84	19%
St. Paul, Minn.				59	75	64	129	183	508	102	86	28	27%
Chicago, Ill.							4000	4500	8500	4250	250	470	11%
Detroit, Mich.													
Grand Rapids, Mich.		254	254	254	254	518			1584	307	349	42	13%
Jackson, Mich.		44	44	44	44	88			264	55	212	9	17%
Kalamazoo, Mich.	71	61	48	121	74	65	72	69	581	75	182	8	4.4%
Milwaukee, Wis.				198	180	351	571	405	1709	342	108	62	18%
Sioux Falls, So. Dakota				125	157	122	119	150	673	135	1310	32	24%

In Milwaukee it is shown that the wards inhabited by the wealthier classes, who form large camping parties during July and August, record a larger number of cases of Typhoid in October than the local conditions could warrant. It has been suggested, and to a certain degree correctly, that it is possible for Typhoid to be taken into these homes by the servant force, who largely come from the poorer, more densely populated, and unsanitary districts. The fact is evident, however, that the servant force is either with the camping parties, or on the

return of such parties has not been in the home sufficiently long to infect the various members of the household.

I simply mention these facts to show the complexity of handling Typhoid Fever. The theory that by furnishing a pure water supply to the larger cities would control Typhoid Fever has been entirely exploded. The facts in the Middle West, and I believe the same are true throughout the United States, show that it is as much a problem in the rural districts as it is in the urban centres, and the campaign against Typhoid must be waged in each locality that contains a population of 40 or more per sq. mile.

In the Middle West we are not confronted so frequently with a mistaken diagnosis of Typhoid Fever for malaria. Very few deaths are recorded in this group of States from malarial fever. In malarial districts it has been shown that there is nearly a 50 per cent. error in the recording of Typhoid statistics due to mistaken diagnosis for malaria. We have, however, a factor in the Middle West which causes the morbidity and mortality statistics from Typhoid to be less than the actual number present. The fact of there being a considerable number of Typhoid cases in any municipality tends to lessen the commercial advantages of such municipality and leads the officials in certain instances, as well as various members of the medical profession, to have the cause of death mis-stated, the complications of Typhoid being given as a factor in producing death, such as pneumonia, hemorrhage, peritonitis and not the disease Typhoid itself. Conservatively speaking I believe we are justified in recording at least a 10 per cent. error in the mortality returns. This possibility of error, however, has not been taken into consideration in compiling the tables.

I have inserted a number of tables classifying the morbidity and mortality statistics of this group of States, in some giving the conditions as they are reported and in others the tables are based upon conservative estimates, using as a basis those States

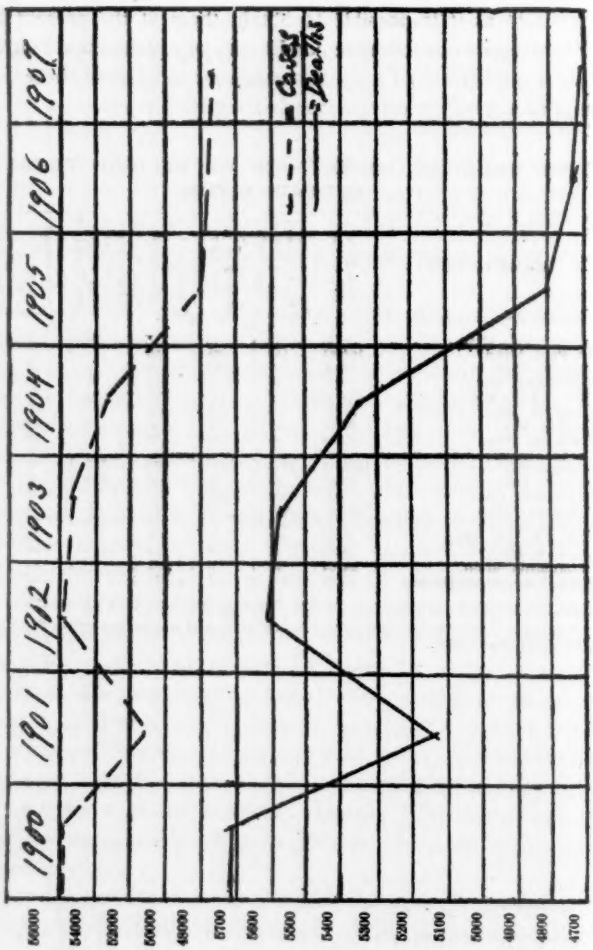
where the estimated morbidity and mortality statistics are as accurate as it is possible to obtain them at the present time. The occupations, climatic conditions, population, and source of water supply are of a similar character in each of these States and therefore the comparison is a legitimate one.

THE RELATIVE IMPORTANCE OF TYPHOID FEVER IN CERTAIN CITIES

NAME OF CITY	Population 1900 census	* Estimated No. of cases per year from 1900–1907	Average No. of deaths per year from 1900–1907	* Estimated No. of cases per 100,000 pop. for City	* Estimated No. of cases per 100,000 pop. for State	Deaths per 100,000 population for city.	Deaths per 100,000 population for State.
Minneapolis, Minn.	202718	444	84	218	96	41	19.3
St. Paul, Minn.	163065	140	28	86		17	
Duluth, Minn.	52969	175	35	330		69	
Burlington, Iowa	23201	40	8	173	42	34	89
Milwaukee, Wis.	285315	342	62	108	44	22	13
Superior, Wis.	31091	100	20	322		64	
Racine, Wis.	29102	50	10	172		34	
Oshkosh, Wis.	28284	45	9	160		32	
La Crosse, Wis.	28895	35	7	120		25	
Chicago, Ill.	1698575	4250	470	250	135	29	27
Canton, Ohio.	30667	60	12	200	155	42	31
Cincinnati, Ohio.	325902	850	166	250		51	
Columbus, Ohio.	125560	300	60	240		48	
Detroit, Mich.	285704	350	70	122	140	27	28
Grand Rapids, Mich.	87565	307	42	349		48	
Jackson, Mich.	25180	55	9	212		34	
Kalamazoo, Mich.	24404	75	8	182		20	
Sioux Falls, South Dakota.	10266	135	32	1310		310	

* Estimated number of cases using the morbidity and mortality reports for Michigan and Indiana as a basis.

TABLE NO. V.
ESTIMATED CASES OF AND ACTUAL DEATHS FROM TYPHOID FEVER BY YEARS



THE EPIDEMIOLOGICAL DIAGNOSIS AND TREATMENT OF TYPHOID OUTBREAKS*

By H. W. HILL

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The objects of this paper are first to outline a system for the diagnosis of Typhoid epidemics—and second to describe "The Typhoid Tourniquet" or method used in Minnesota for suppressing Typhoid, without waiting for the discovery of the source.

Although I shall consider diagnosis and treatment in this order, treatment of a general characer, as by the "Typhoid Tourniquet" should come first in actual practice.

TYPHOID OUTBREAKS IN GENERAL.

Typhoid outbreaks of many types exist, water outbreaks, milk outbreaks, fly, food and finger or contact outbreaks. Each of these may be explosive or slow spreading; massive or scattered; they may occur as household, neighborhood, disseminated or community outbreaks; or, in form, as epidemic, endemic, or prosedemic. I shall attempt the ambitious task of classifying epidemics under certain heads, as a study necessarily preliminary to the diagnosis in practice of epidemics as they present themselves. But Typhoid transmission is after all a unit; it is nothing but the transfer of Typhoid infected urine, feces and saliva, from the patient, convalescent, or carrier, to other people's mouths. All our various forms of outbreaks are merely the results of the following, by Typhoid infected feces, chiefly, but also of Typhoid urine and saliva, of various

* Read before the American Public Health Association at Winnipeg, August, 1908

paths, laid out and made possible by the intricately imperfect sociological conditions of modern life, and the tracing of the exact paths which these delectable delicacies have followed, in any given case, is Typhoid Epidemiology, in substance.

Typhoid outbreaks may be classified either by vehicle of transmission or by locality distribution. The latter is the more practical primary classification for epidemiological diagnosis since the locality distribution of an outbreak is the first and most easily determined circumstance. Classification by vehicle of transmission cannot of course be made in any given case until the vehicle of transmission is found, and is therefore a *post facto* matter.

For diagnostic purposes, the distribution, (i.e. as to locality), the concentration (i.e. whether massive or scattered) and the rate of onset (i.e. whether explosive or slow spreading) are the most important initial points to be ascertained. Taken together with a study of the sociological conditions amongst which the people concerned live, any Typhoid outbreak will yield a diagnosis sooner or later in face of persistent accumulation of detailed data. But certain sociological conditions are so basic and so universal, that they everywhere govern at least the broad general outlines of outbreaks and amongst these the mere physical grouping of the homes of the people lie at the foundation.

Typhoid Fever, whether found in the isolated family on the farm or in the great city is essentially a communistic disease—a disease peculiarly dependent for transmission on the common ownership of alimentary utilities. Unlike smallpox and some other diseases, mere association of people in the same house or locality will not account for its spread—their association must involve actual contact, or, especially for large outbreaks, communistic use of the same infected food or drink.

The potential capacity of a given locality for propagating Typhoid may be measured *a priori* by estimating the amount of communism in food and drink which obtains there.

The degree of likelihood of this potential capacity for Typhoid Fever infection becoming a reality may be determined *a priori* by estimating the amount of normal fecal and urinary infection which ordinarily enters the food and drink supply under ordinary conditions together with an estimation of the transient traffic in Typhoid convalescents and Typhoid carriers. Any community, through extraordinary combinations of circumstances, may admit to its alimentary utilities the undesirable item of Typhoid excreta; but some communities at all times possess an admixture of normal excreta with the food and drink so constant and so extensive, that to induce Typhoid excreta no unusual road need be found because well beaten paths already exist in such communities by which normal excreta daily circulate amongst and between the sewage, the food, the privy vault, the food, dirty hands, flies, and the food, and are open to any casual Typhoid infected stool also.

CLASSIFICATION BY LOCALITY DISTRIBUTION.

In considering distribution, the epidemiological unit is the household because it is in the household that communistic interests in the same food and drink, the same flies and hands, are always prominent. But the epidemiological household is not necessarily coincident with the family in its ordinary sense. It includes not only isolated families on the farm or in the community, but also boarding houses, hotels, institutions, even hospitals, factories or whole camps, civil or military. The next multiple which the epidemiologist recognizes is the neighborhood—a somewhat indefinite but convenient term, including those in the immediate vicinity of a household, who by mere propinquity rather than by friendship share somewhat in the family life; a neighborhood often uses the same well, the same cow's milk; and has a communistic interest in the same privy vaults, through sharing the attentions of the same flies. The next multiple is the community, composed of several, even numerous neighborhoods, between and amongst

which some at least of the alimentary utilities are shared in common. An epidemiological community therefore may be only part of a municipality, as for instance, the part having a common water supply, or the locality to which is restricted the route of a given milkman.

Besides the distribution by locality, (household, neighborhood, community) there must be recognized a distribution which does not primarily relate to locality. Epidemiological communities of interest other than in food or flies of course exist, such as those which draw people from different localities together as to dinner parties, church entertainments, school reunion dinners, etc., and the Typhoid which so results may be called social Typhoid. In milk and water, and fly outbreaks the infection is carried from a common source to its victims scattered in the community; but in social Typhoid the prospective victims carry themselves from scattered points to the common source of infection. The distribution of Typhoid originating from a social meeting is therefore much like the distribution of a milk-route outbreak, but of course one correlates with the milkman's list of customers, the other with a list of members of a certain social set, of a given church, or school, etc.

When to the factors of distribution are added the factors of concentration and rate of onset, a sufficiently complicated set of conditions to unravel is presented to satisfy the most ardent enthusiast of intricate problems. Household Typhoid may be massive or scattered—explosive or slow-spreading. Neighborhood Typhoid may be massive or scattered—explosive or slow-spreading. Community Typhoid likewise—and of course the original sources of infection in operation may be multiple (as when flies spread infection from several points at once in several adjoining neighborhoods) or both multiple and varied—as when in the same town flies may be responsible in one district, water in another; or all three may operate at one time in one district, the sources being therefore

multiple, varied and coincident; and in all long established outbreaks, especially if neglected, the source of the primary infection is obscured by the multiplicity of secondary foci established in hotels, restaurants, milk-plants, etc., not to speak of such secondary foci as infected families, convalescents and carriers. These forms of outbreak necessarily overlap and spoil the typical picture of initial distribution. Endemic and prosedemic Typhoid is undoubtedly generally of this character, the primary outbreak having long since exhausted itself, leaving no trace of its original form.

SUB-CLASSIFICATION BY VEHICLE OF TRANSMISSION.

Finger or contact Typhoid is undoubtedly the primeval form of Typhoid transmission, requiring the simplest mechanism and but two factors—one, the patient, the other, someone nursing him. This must have been the method of Typhoid transmission in the prehistoric days before our ancestors had formed the simplest communities—when individual families existed alone, living nomadic lives. The mother then, as the mother now, and all through the ages, nursed her sick with the mother's omnipresent love and care. Then as now, the unsuspecting mother, conveyed the discharges to her own mouth, and to the mouths of her family, both directly on her hands and of course indirectly, through her hands touching their food. Water supply infection was probably uncommon in the nomadic times, for the wandering families seldom stayed long enough in one place for both infection and use of the supply by others to occur; and large natural supplies were doubtless generally in use, great rivers, lakes, swift streams—rather than ponds or wells. The absence of communities reduced the chances of serious infection of these waters; their size made dilution an enormous factor in reducing what infection reached them.

Fly infection also doubtless played a part in prehistoric Typhoid. Unlike contact infection, however, it required three factors, the patient, the fly and the food. It was restricted in operation (as contact infection was not) to only part of the year—i.e. fly time and part of the day—daylight. It was further restricted as compared with contact Typhoid in that the conditions necessary for its operation might sometimes be non-existent—doubtless some families even in those days, buried their discharges—and perhaps some may even have kept flies from their food. The cooking of foods when introduced must have also tended to minimize this route of transmission.

Hence direct contact stands out as the oldest, most constant, and most difficult to prevent by public action of all forms of Typhoid transmission. It is the ancient barbarous form—and is found today in all communities where Typhoid nursing is still in a barbaric stage.

Fly infection is also a relic of barbarism. It is now found chiefly in the camps of those who, reverting to the camp life of their ancestors, revert also to their ancestors' primitive ideas concerning camp hygiene. It is found therefore in the town supplied with privy vaults instead of sewage systems, because such towns are, from an epidemiological standpoint, mere camps, with tents of wood instead of hide or bark.

These two, contact and fly infection, are primarily household routes of infection, but fly infection occurs also as a neighborhood matter.

As a household matter fly contact may exist with or without sewage, in any community, even the largest, most civilized, where prompt disinfection and disposal of feces in the bed chamber does not exist; but only in fly time; and only where neglect of feces, and of the screening of food after cooking, or of raw food is found. As a neighborhood matter, a fly outbreak may be found in any community where tremendous overcrowding exists, as for instance in tenement districts of even the great sewered cities, i.e., where the neighborhood

reverts practically, so far as flies are concerned, to a household, having its flies in common; but it chiefly occurs in new communities, not so crowded, having outdoor privy vaults, open to fly visitation. An explosive community outbreak from flies can hardly exist, unless the community be very condensed, practically a neighborhood, a military camp, etc., or the infection be multiple—i.e., from a number of vaults infected at the same time. Extension by slow spreading may occur where privy vaults are in use, for of course, the neighbor has a neighbor, and the neighbor's neighbor has a neighbor.

The next stage above the nomad is found when families settle down, in camps, whether of canvas or wood. Then the household infection of contact and flies become neighborhood matters and the introduction of household wells, often used by three or four families in common, introduced a new form of outbreak, due to private or "own wells." The individual or "own well" stage gives outbreaks limited to the family, sometimes, if neighbors use it, to the neighborhood. From studies made amongst the new settlers in the northern districts, I deduce that the well of our primeval ancestors must have been an eight-foot hole in the ground, neither round nor square, as close to the back door as possible; that a few logs were thrown criss-cross upon it to prevent horses and children from falling in, dogs and chickens being supposed to get out themselves; that the younger members of the family fished in it for frogs; that water was drawn from it by whatever was the primeval variant of a tomato-can tied to a string; that rains washed the surroundings into the well and floods washed them out again; and that the serious contamination of the well by surface drainage depended merely on the relative elevations of the well and of the family toilet-bush. In such days or under comparable conditions now the family well plays a part in family typhoid and when neighbors use it, in neighborhood typhoid. I believe, however, that, except when excep-

tionally badly placed, so as to receive surface drainage from Typhoid infected feces or when sunk into creviced rock or gravelly strata, open to infection, at a nearby point, the family well of today, even the dug or bored well, but particularly the drilled or driven well is usually not a factor in family or neighborhood Typhoid. The search for family infection from such family wells on the farm is usually futile, so far as I have seen, if the mouth of the well be properly protected. On farms, the initial case comes not from the well, but from the city, and in general secondary cases on the farm arise from contact, flies or milk rather than from well infection.

The next higher grade of civilization is shown by the community having a common water supply, but as yet no sewerage system, i. e., a camp with a public water supply. Such a community is subject to the contact and fly outbreaks common to all camps, but has in addition the additional danger, due to partial civilization, introduced by the fact that all use the same water. A town with individual wells cannot have an explosive water-borne outbreak of Typhoid on such a scale as is possible in a similar town having a public water supply, except under conditions which make the individual wells mere separate pockets of what is truly one common public well—such as floods; or the use of a common water-bearing porous strata. Hence the introduction of a water supply into a town introduces a new source of danger, the community outbreak, but usually municipal pride in the progress of the town is so occupied with congratulating itself on the advance in civilization thus made, that the new dangers and responsibilities inevitably entailed, are usually overlooked.

The town possessing a water supply and a sewerage system is better off than the town possessing a water supply and no sewerage system, simply because the sewerage system cuts out largely the likelihood of fly infection, and

in a minor way, because indoor toilet rooms, which go with sewerage systems, conduce by moral effect and by warmth and comfort in winter, to greater personal cleanliness, thus tending to eliminate contact.

In the earliest stages of the development of a town, each householder has his own cow—or two or three neighbors use the milk supplied by one. At such a stage, milk outbreaks are limited to households and neighborhoods. With the advance of the town to the stage of water and sewerage installation, regular milk dealers, having twenty-five to one hundred or more customers on their routes begin to appear. As the "own well" stage of a town can rarely furnish a massive or community water epidemc, so the "own cow" stage rarely if ever can supply a massive or community milk epidemic. But the introduction of large milk routes, like the introduction of public water supplies, gives at once the needed apparatus for massive milk epidemics—less widespread, it is true, than in public water supply outbreaks, because few milk routes ever secure so wide a distribution of their products through a community as does a public water supply.

From the historical standpoint, therefore, the status of civilization in a given community can be fairly well established from the character of its massive Typhoid outbreaks —the crude frontier community, little more than a camp, except that wood has superseded canvas—shows family and neighborhood fly outbreaks, family and neighborhood milk outbreaks; sometimes family and neighborhood well outbreaks. The next stage in civilization introduces the community water supply outbreak—and when time and sore tribulations have at last taught the lessons of carefully guarded water supplies and the abolition of the privy pit, milk supplies furnish the outbreaks. Of course the silver thread of contact runs through all stages.

So far then, and with certain qualifications, we divide pri-

mary Typhoid by distribution into household, neighborhood, disseminated and community Typhoid. By method of transfer, we may recognize contact as peculiar to household distribution, flies, "own wells" and "own cows" to household and neighborhood; milk routes, dinner parties, etc., to disseminated, and water to community Typhoid. Once a primary epidemic is established, all forms of transmission may occur thereafter, and hence what was originally a milk, water or fly outbreak in a family or neighborhood may become, if neglected, finally a secondary community outbreak.

RATE OF ONSET.

Contact Typhoid is slow moving, usually, because usually the mother or nurse is cleanly (although often illogically so) in her habits; much of the food she handles is cooked. If her hands are not washed before she begins preparing a meal, they often are before the meal goes on the table—washed in the food itself—and such food as is heated thereafter, is sterilized; usually green vegetables, ice, butter, etc., are set on the table last, after the cooking is finished, so that the removal of infection to the food to be cooked which precedes the laying of the table leaves her hands reasonably clean at this later stage. In general, contact Typhoid is not explosive, although there are such cases on record, the explosiveness depending merely on the number of persons exposed at one time to the initial cause. Fly outbreaks may be slow spreading or explosive, rarely massive; but if an unusual number of persons are exposed, at one time, a fly outbreak may be both explosive and massive; milk outbreaks are usually explosive and scattered; water outbreaks usually explosive and massive.

INVESTIGATION.

With these outlines of what to look for laid down, the

process of the investigaton may be proceeded with. The following information must be obtained.

1. A knowledge of the sociology of the community, its population, nationalities, chief occupations, relative proportions of the different classes to each other.

2. The character of the water supply, the milk supply, the food supply, the disposal system for sewage, the prevalence of flies.

3. The social relations of its people.

4. The dates of first symptoms, (from which the states of infection may be calculated) the distribution of the Typhoid cases—the individual water, milk and raw food supplies and sewage disposal of each; their work, social relations; their association with previous cases, and, where possible, with convalescents and carriers.

In practice by far the quickest method is to secure the individual data for each patient first, by visits to the patient or the patient's family, studying by observation and inquiry the other factors above mentioned as the visits are made. The marshalling of these cases in order of occurrence will then furnish the basic data. It is most important to use the dates of infection for all plotted maps, tabulations, etc. The date of reporting is exceedingly misleading.

The next step will be to eliminate secondaries, sometimes a long and tedious process, but quite essential to tracing the original source. By the time the epidemiologist reaches the ground epidemics almost always show secondary foci centering about the untrained nurse, and about the infected hotel waitress, the infected milk peddler, etc. In practice it is usually safe to consider all but the first case in each family as a secondary, especially if between cases an interval of two or more weeks is found, unless evidence exists to show that the primary source still acted and that cause of secondary infection were eliminated by proper house-

hold care. From the remaining or primary cases the origin of the outbreak may be traced.

Notwithstanding that epidemiologists recognize these distinctions it is unfortunately only too true that as soon as cases of Typhoid are reported in an isolated family, a community, a city district, an institution, anywhere, the one idea of the public, the physician and alas too often even the health officer is to analyze water—to write to the City or State Board of Health, enclosing in a vinegar jug, stoppered with a beer-bottle cork, a sample of the well in the back yard of the patient's home. By the time the report is returned—if the State Board is so short-sighted and futile as to analyze such specimens and report on them at all—the outbreak has gained headway by the space of a week or more—more people have used the infected water, if it be infected—more people have used the infected milk, if that be the source—more people have suffered contact or fly infection, etc.—and the fruits of the delay show themselves by an increase of cases in due time. The health officer has learned that Typhoid is not always due to water, the physician is learning—some day even the public may appreciate it also.

THE TYPHOID TOURNIQUET.

If the simplest epidemiological information could be substituted for the so prevalent old wives' fables relating to wells and water, Typhoid Fever could be cut in half merely because then the physician and the health officer would begin to act without waiting for water analyses, or even for a list of the Typhoid cases. The first duty of the health officer, who knows that Typhoid exists in a community is not to make an investigation, but is to face the actual status—to treat the emergency symptoms, without waiting for the discovery of the ultimate cause. If a man is spurting blood from a wounded thigh, the surgeon does not wait

to determine the exact nature and extent of the lesion—nor even the exact vessel concerned—he throws a tourniquet around the whole limb to stop the flow—and then at leisure he investigates, finds the vessel or vessels concerned, and ties it or them in a systematic fashion according to approved surgical canons. Exactly parallel is the condition of a community suffering from Typhoid. Instead of laboriously searching for the particular source—a search which may take weeks, years, or even, as in Washington, D. C., a decade—the proper course is to stop the existing epidemic. To do this requires an immensely vigorous publicity campaign, but it can be done. In Minnesota our first gun is fired—not at the water supply, for we can not know at first that the water is infected—not at the milk supply, for we cannot know at first that the milk is infected —not at the raw food, or flies—we cannot know at first that these are responsible—not at fingers even, although it is always safe to assume that fingers are a factor in every outbreak. We cannot attack any one of these, when first called in, because at that time we do not know which is the cause. We attack every one at once, as the surgeon in the parable ligatures the whole limb. Later we pick out at leisure the particular source and cut that off.

The method is very simple. On finding a Typhoid outbreak in a town, we issue in the papers, display on the streets and address to every householder the following placard:

To the Citizens of Blank.

TYPHOID FEVER IS EPIDEMIC in Blank.

The Minnesota State Board of Health is investigating this epidemic to find its exact source. Meantime govern yourselves as follows:

1. TYPHOID FEVER is contracted solely by the mouth. If you do not put the poison of Typhoid Fever into your mouth YOU WILL NEVER CONTRACT TY-

PHOID FEVER. Therefore, WATCH THE MOUTH.

2. DO NOT EAT OR DRINK ANYTHING (water, milk, oysters, fresh vegetables or anything else) UNLESS it has been first BOILED, BROILED, BAKED, ROASTED, FRIED or otherwise THOROUGHLY HEATED through and through.

3. DO WITHOUT ALL FOOD OR DRINK which has not first been thus heated. (Canned or bottled foods or drinks (other than milk or water) are not included in this.)

4. If living in the same house with a Typhoid Fever patient, DO NOT HANDLE YOUR OWN FOOD, or food intended for anyone else, even if it has been heated, except with HANDS that have been THOROUGHLY WASHED with soap and very hot water. (Preferably also with antiseptic—ask your physician about the antiseptic to use.) WASH BEFORE EVERY MEAL in this way and before cooking, serving or eating ANYTHING OR PUTTING THE FINGERS IN THE MOUTH.

5. If there are flies about, see that all food and drink is protected from them at all times. Flies often carry Typhoid poison to foods and drinks.

6. THE POISON OF TYPHOID FEVER does not show itself for TWO WEEKS after it enters the body. Therefore for the next two weeks, Typhoid cases may develop from Typhoid poison already taken in. But any case which develops on and after (a date two weeks later than the date of the placard) will be due SOLELY TO NEGLECT of this notice and failure to carry out minutely the directions here given.

Later more detailed information is published or mailed concerning contact, convalescents, etc., from time to time. The physicians of the community are visited separately or when possible addressed at a meeting convened for the purpose; in both cases, with the object of posting them on the simple essentials of epidemiology—contact Typhoid,

flies, milk, dangers from convalescents, etc. The successful stopping of a Typhoid outbreak depends on the vigor with which the public, but particularly the physicians can be impressed with facts which neither physicians nor public usually believes—that Typhoid Fever is not necessarily a matter of infected water—and is not even a matter of garbage piles, sloughs, damp cellars or sewer gas—but is a matter of Typhoid discharges reaching mouths. Trained nurses are sent to circulate amongst the poor families, not to nurse but to teach by demonstration how to avoid secondary infection, and every reported case is investigated to determine if the source of infection be primary or secondary in order to cut off the latter.

After getting out this notice, seeing the physicians, etc., as above outlined, lists of the cases to date are obtained direct from the physicians (because the cases are usually not yet reported in full to the health officer,) and then the next step is to see the individual patients and secure from them the epidemiological data.

If physicians are to be efficient and earnest co-operators in epidemiology with health officials, this, and not the mere "report of cases of Typhoid" must be the form required of the physician in his initial report. Until the good time comes when health departments, weary of receiving physicians' reports on Typhoid Fever which convey no useful information, except that a supposed case exists at a certain or uncertain address; and until the health departments, especially State health departments realize that the useful information which the physician might supply when he sees the case early, before the lapse of time, delirium, the exhaustion of the family members from nights of nursing and days of anxiety spoils the evidence, should not be left to be acquired if at all, weeks later, we shall not have epidemic records worthy of the name. When that time does come—when every Typhoid case is regarded seriously, promptly reported,

and immediately fully investigated by trained men with full information as to previous associates, milk, water, etc.—we shall not have epidemics at all—or at least only those which arise from peculiar complications of circumstances, beyond human ingenuity to forestall.

From the data thus secured, the distribution of the Typhoid as it stands at the time is ascertained. Then by the dates of onset of the cases, scrutinized in the light of the data secured as to the chances for contact, and the establishment of secondary foci, all secondary cases are eliminated. This most important step leaves the primary cases to be plotted on a map, and in this way the locality distribution of the original outbreak is ascertained. Applying now our formulae regarding the different causes of the different locality distributions, again in the light of the data as to contact, milk supply, water supply and sewage disposal conditions, the primary cause or causes are determined. Systematically applied, with a sufficient force of trained data-collectors, and with sufficiently energetic and pungent publicity, first the outbreak should be stopped, and second the cause or causes of any ordinary primary outbreak of Typhoid should be found ordinarily within a week or two. When the cause is found, its treatment will be indicated by its own characteristics. Mechanical or physicial deficiencies in a public water supply may be remedied, infected wells disinfected or abandoned, fly-breeding places abolished, houses screened, Typhoid cases, convalescents, perhaps even carriers, removed from milk-handling positions, mothers, nurses, physicians instructed regarding contact infection, and the community placed in a position to obviate recurrence.

But, alas! often the community concerned is too poor, or too unbelieving to follow advice concerning waterworks, reconstruction under supervision, sewage disposal plans, etc.; when the epidemic is over, the old conditions, spas-

modically bettered, are allowed to return, and many times the final abolition of the Typhoid must wait for the growth of a new generation.

CERTAIN CONCLUSIONS CONCERNING TYPHOID FEVER IN THE SOUTH, AS DEDUCED FROM A STUDY OF TYPHOID FEVER IN RICHMOND, VA.*

By ERNEST C. LEVY, M. D., Chief Health, Officer, Richmond, Va., and ALLEN W. FREEMAN, M. D., Assistant Health Commissioner of Virginia †

ABSTRACT.

The study presented in this paper consists of (1) an analysis of the Typhoid mortality statistics of Richmond since 1880, as obtained from the original certificates of death, and (2) the more accurate study which has been made of every case of the disease reported to the Richmond Health Department since May, 1907. Under the latter division the results of one year's investigation (May 1, 1907, to April 30, 1908) are given.

As a result of this study, the authors arrive at the conclusion that Typhoid Fever is naturally more prevalent in the South than in the North in communities with equally good water and milk supplies—in short, that in the South "residual" Typhoid is higher than in the North, on account of the greater length and intensity of the hot season, during which, both North and South, there is normally a marked increase in the Typhoid death rate.

Basing their argument on the fact that all the historic water-borne epidemics of Typhoid Fever have been in other than the Winter months, and on the fact that cities

* Author's abstract. The full paper (30 pages, with 3 maps, 3 cuts and 1 folded insert) reprinted from the Old Dominion Journal of Medicine and Surgery, Vol. VII, Nos. 5 and 6, may be had on application to either of the authors.

† Formerly Medical Inspector, Richmond Health Department.

with water supplies which are known to be polluted commonly have a Winter Typhoid death rate higher than that of the summer months, the writers conclude that the greatest danger of contaminated water supplies in the causation of Typhoid Fever is in the Winter months rather than in the Summer.

Elaborating this conception, the writers bring arguments to show that public water supplies are naturally a less important factor in the causation of Typhoid Fever in the South than in the North. They emphatically disclaim any intention of underestimating the importance of pure water supplies or of undervaluing the work of "those great men to whom we owe our knowledge of this important branch of sanitary science, as well as those who are today bringing to the people the practical benefits of these teachings."

Although the writers believe that water supply is far from the chief factor in the etiology of Typhoid Fever in Richmond (and, presumably, throughout the South,) they are able to fix the responsibility for a small outbreak in Richmond in January and February, 1908, on the public water supply—74 cases out of a total of 557 during the entire year.

The writers compare at length the Typhoid records of Richmond with those of Washington for a period of twenty-eight years, and show, by tables and a diagram, a remarkable parallel between the Typhoid death rate in these two cities, although the water supply of Richmond has remained unchanged during the entire time, except for the worse, while the water supply of Washington has been four times decidedly changed, and although previous investigators have attributed certain marked fluctations in the Washington rate to these changes.

From this, and other features of the case, the conclusion is drawn that " there must be some little understood influences of a very widespread character, varying from year

to year, which play a more important role in the epidemiology of Typhoid Fever than has yet been recognized."

In conclusion, the writers state that, as regard further efforts to limit Typhoid Fever, "sanitarians must be content to gain less spectacular victories than those which follow the substitution of a pure water supply for one that is polluted. Having secured a good water supply and thereby having reduced the Typhoid Fever death rate twenty, fifty, a hundred, or even more per 100,000, they must be willing to gain the next five or ten points by efforts ten times as laborious to install and a hundred times as hard to sustain." The directions which these efforts must take, in the light of our present knowledge, which is admittedly imperfect, are indicated in thirteen recommendations.

DISCUSSION.

Dr. John A. MacDonald, of Brandon, Manitoba.—Mr. President: I am under the impression that we are rather inclined to search for the cause of Typhoid Fever too much in water supplies, and I do not think sufficient attention has been given to flies as causal agents of this disease. In corroboration of that, I would say that, notwithstanding the advanced measures taken in Winnipeg, as pointed out by Dr. Douglas, and the results obtained this year and last year, by a strange coincidence the same decrease in the number of cases of Typhoid Fever has taken place in the Province of Manitoba, and by another coincidence, practically the absence of flies accompanied this extraordinary decrease in the number of cases of the disease. The comparative absence of flies this year has also been accompanied by an extraordinary decrease in the number of cases. The town I came from, Brandon, a hundred and thirty-two miles West, also has an equally favorable report with regard to the decrease in the number of cases of Typhoid Fever. The country districts surrounding Bran-

don, which send a number of cases to our hospital, also had an accompanying decrease, both in the number of cases last year and this year. We have been in the habit of having an annex for our Typhoid cases, which was fully occupied during the preceding years by patients, but which we did not open last year nor this year. We have only had three cases sent to the hospital from the city of Brandon this year. Last year we had, I think, in the neighborhood of twelve cases, and we have been in the habit of having twenty, forty, and fifty cases. We cannot help thinking that the absence of flies has had a great deal to do in helping us out in decreasing the number of cases of Typhoid Fever.

With regard to closets, of which Dr. Douglas spoke, I have insisted on metal buckets and a supply of earth being thrown on the excreta each time in the case of pit closets, to exclude flies from coming in absolute contact with the excreta. I have found that that works fairly well. In addition to that, we have a system of having two slop barrels, one for dry, and the other for wet, garbage, both of which are screened from flies. There has been no alteration made in any other plan of the sanitary arrangements, and our most earnest effort has been to guard against flies coming in contact with the excreta.

Dr. William C. Woodward, of Washington, D. C.—I think we are inclined to lay too much stress on the relation between flies and Typhoid Fever. It does not follow because the fly season and the Typhoid Fever season come at the same time, that therefore the flies are the cause of Typhoid Fever. It seems to me not unlikely that some of the causes that promote the life of the flies either favor the life of the Typhoid bacillus or possibly favor the dissemination of other agencies, or maybe reduce the human organism to a condition in which it is more susceptible of

attack than at other seasons. Nevertheless, I believe in working against flies.

Our experience in Washington has been a peculiar and trying one, and the more we study the situation, the less we feel certain of our ground. Our latest movement in Washington toward the prevention of the disease is to require the registration and systematic inspection of every place where food is made and sold, so as to permit careful and systematic control of such places, with a view to insisting on the utmost possible cleanliness. We have passed an ordinance requiring everyone who takes in washing for pay to register. We have not passed as yet any particular regulations concerning the sanitation of these places, but we intend to maintain systematic inspection of all establishments of that kind; specific regulations, if promulgated, will be based on observations. We have promulgated a regulation thus made requiring everyone who maintains a stable, to register, so that we can maintain the same systematic inspection of places of that kind.

Dr. Gardner T. Swarts, of Providence, R. I.—The Health Officer should not be chagrined if he is not successful always in tracing the source of an epidemic of Typhoid Fever. It is very essential that routine methods be carried out, and that water supplies, milk supplies, and flies as carriers of the bacilli of the disease be considered.

We should practice routine methods, such as the inspection of farms which supply milk, and water supplies, try to obtain the Widal reaction in the members of the family, in which there is a case of Typhoid Fever, examine the feces and urine, and in this way endeavor to find the source of the disease, utilizing both negative and affirmative evidence. These methods have been brought before us and developed in such a scientific way, that we can now

make statements more clearly as to the pros and cons in these cases than we could a year or two ago.

Dr. John F. Anderson, of Washington, D. C.—In reference to the investigation of Typhoid Fever in the District of Columbia by the Public Health and Marine Hospital Service, I will say that we have recently selected three blocks and have arranged to get specimens of the feces from every person living in those blocks, with a view to examining them for Typhoid bacilli. From an examination of the feces of 191 persons, we found one that was a bacillus-carrier. His feces had been examined three times, and each time we found a pure culture of the Typhoid bacillus.

Dr. Hibbert W. Hill, of Minneapolis, Minnesota.—A great deal of pains is taken in most places to trace Typhoid outbreaks to their source. Inability to handle an epidemic until the source of the outbreak was found seems to have been assured. Now, in Minnesota, as soon as we get into a town where an epidemic of Typhoid Fever exists, we issue a placard, giving instruction to prevent Typhoid Fever, which is placed on every city block and published in the newspapers. It is also mailed directly to all householders in the city or town.

There is no detail of protection against contact Typhoid which does not need to be explained and demonstrated in the minutest form to the person who has actually to attend to it. By throwing this tourniquet around the whole epidemic at once, we have had great success.

I wish, to move the appointment of a committee to consider the question of Typhoid in every respect, but particularly to agitate in every manner the reporting of cases of Typhoid Fever, and directing their efforts to the munic-

ipality, the health officers, and the individual physicians. A concentrated movement all over this country should accomplish much more in securing reports than spasmodic efforts in isolated places. (Seconded and referred to the Executive Committee.)

Mr. Harry E. Jordan, of Indianapolis.—I desire to call attention to the report of Major Roberts, of the Indian Government, regarding the condition of the soldiers in the Indian Army Service. He points out that the English soldiers were most affected by Typhoid Fever during the Summer months of the Indian year, while the Indian soldiers were effected by the fever during the Winter months. The conclusion he draws is that Typhoid Fever was most prevalent among different individuals during that season to which they were less accustomed by heredity or past conditions of living, and which affords the greatest drain upon their vital resistance. Although they may have received an infection from some source into their system during other seasons of the year, during that season to which their mode of living was less accustomed, they were more susceptible and the morbidity resulting from infection from that source becomes greater.

Laboratory Section

A METHOD FOR THE DETERMINATION OF NITRATES IN SEWAGE AND WATERS OF HIGH CHLORINE CONTENT †

By H. C. McRAE
Chemist Baltimore Sewage Commission

When the sewage testing plant of the Baltimore Sewerage Commission was started in operation it become necessary to make large numbers of determinations of nitrogen in the form of nitrates, and as there was no known accurate and rapid method for this determination, in the presence of high chlorine values, it was thought advisable to make some investigations in hopes of arriving at a satisfactory method.

It was known at the outset that nitrates could be determined, within certain limits, by the so-called brucine method, in which a small sample is treated with brucine in sulphuric acid solution and compared with similarly treated standards, or with permanent standards prepared with a solution of potassium bichromate. The knowledge of this method led to the thought that other alkaloids might be of more value and with this idea in view the following investigations were made.

QUININE:

Quinine sulphate in sulphuric acid solution, 0.2 gram of the salt to 50cc acid, was added to solutions containing,

† Read before the Laboratory Section of the American Public Health Association, at Winnipeg, August, 1908.

respectively, 0, 0.000001, 0.000002, 0.000003 grams of nitrogen as nitrate. A flourescent blue color developed, but without showing a satisfactory graduation to correspond with the different amounts of nitrogen.

MORPHINE:

Morphine sulphate was tested in the same manner with similar results except that the color developed was brown instead of flourescent blue.

NARCOTINE:

Narcotine was tested in the same manner and from the start showed promise of usefulness. The color developed ranged from pink to cherry red and through a certain range the graduation of the color was excellent. After some experimentation the use of narcotine was adopted in the routine work of the laboratory. Two slightly different procedures, which are described below, were worked out to meet two somewhat different conditions.

First:—when the amount of nitrate present is comparatively large and speed is an important factor.

Preparation of standards and samples. Five standards are prepared by placing, in small, 5 inch test tubes, 1 c.c. of solutions containing, respectively, 0.000000, 0.0000005, 0.000001, 0.0000015, 0.000002 grams of nitrogen in the form of potassium nitrate. Samples of 1 c.c., or less diluted to 1 c.c., are placed in similar tubes, after having been clarified by filtration if necessary.

Preparation of narcotine reagent. .0.1 gram of narcotine is weighed out and dissolved in 50 c.c. of sulphuric acid as quickly as possible, with the aid of a stirring rod.

As soon as the narcotine is completely in solution, the reagent is quickly added to both the samples and the standards and the contents of each tube thoroughly mixed by twirling. Readings are made in from fifteen to twenty minutes. By this procedure nitrates can be determined with rapidity and with fair accuracy within a range from 0.5 part per

million to 20 parts per million. Below are given the results of a series of determinations made of solutions prepared in the laboratory, but unknown to the operator. The results are expressed in parts per million:

Actual amounts.	Amounts as determined.
1.0	1.2
1.5	1.5
3.0	3.0
5.0	6.0
10.0	11.0
30.0	30.0

Second:—When the amount of nitrate is comparatively low and accuracy is an important factor.

In order to determine small quantities of nitrates with narcotine it was found necessary to increase the volume of both the sample and reagent. This brings forth a difficulty which makes necessary a more complicated technic. The difficulty is caused by the fact that the intense heat developed, upon the addition of the acid to the water, causes the alkaloid to break down and form a color in the absence of nitrates. This trouble is obviated by using the following procedure:

Preparation of standards and samples. Seven standards are prepared by placing, in 50 c.c. nessler tubes shortened to six inches length, 1 c.c. of solutions containing, respectively, 0.000000, 0.0000001, 0.0000003, 0.0000005, 0.0000007 0.000001,and 0.0000015 grams of nitrogen and diluting to 5 c.c. Samples of 5 c.c., or less diluted to 5 c.c. are placed in similar tubes. 2.5 c.c. sulphuric acid is then added to each tube and the tubes cooled.

Preparation of reagent. First, a portion of the acid to be used is mixed with a portion of distilled water and cooled. The narcotine is then dissolved as quickly as possible in a second portion of acid and the mixture of acid and water added thereto. The ratio of acid to water in the final mix-

ture should be about nine to one and the amount or narcotine used should be 0.1 gram to 50 c.c. of acid.

As soon as the reagent is prepared a 10 c.c. portion is quickly added to each of the standards and samples and the contents of the tubes mixed thoroughly by twirling. Readings are made after twenty to twenty-five minutes. With this technic hundreth's of a part per million can be determined very accurately. The following table, showing the results on a series of solutions, the strength of which was unknown to the operator, will indicate the accuracy with which readings can be made. Results are expressed in parts per million.

Actual amounts.	Amounts as determined.
0.3	0.3
0.3	0.3
0.3	0.3
0.5	0.5
0.8	0.8
0.8	1.0
1.2	1.2
1.5	1.5

While the above table includes no determinations of less than tenth's of a part per million, it is readily apparent that smaller quantities may be determined with equal accuracy, since the use of the full 5 c.c. volume of sample will introduce no error as compared to the use of a 1 c.c. sample, which was used in arriving at the results above.

In conclusion a word of caution in regard to the use of the method may be in place. The reagent decomposes on standing, so that particular care should be exercised to avoid loss of time in adding it to the tubes. Care should also be used to mix the contents of the tubes thoroughly after the reagent has been added. It is not believed that permanent standards can be used successfully with this method, as the color increases in strength slowly even after

long standing. This increase, however, is so slow that it does not interfere with accuracy, provided the reagent is added to the standards and samples at practically the same time. It is realized that the narcotine method, herein described, is not perfect, but it is thought to have some distinct advantages, and it is to be hoped that this presentation may point the way to further improvement. Credit should be given to Mr. G. A. Armeling, Asst. Chemist of the Baltimore Sewerage Commission, for painstaking work in connection with the development of the method.

DEXTROSE VS. LACTOSE FOR DETECTING THE COLON BACILLUS*

By WILLIAM ROYAL STOKES and HARRY W. STONER
Baltimore, Maryland

ABSTRACT.

The classical paper on "The Fermentation Tube" in 1893, by Theobald Smith directed the attention of bacteriologists to the isolation of the colon bacillus from water, milk, and other raw foods. If the gas produced in glucose bouillon varied between 40 per cent. and 70 per cent., the writer thought that all types might be eliminated except *B. coli, B. lactis aerogenes* and *B. cholerae suis.*

The investigation of the river waters of Illinois by Jordan demonstrated that the *B. vulgaris,* the *B. cloacae,* the *B. cholerae suis* and the *B. gasoformans* all produced gas in dextrose, whilst practically only the colon bacillus fermented lactose bouillon with the formation of from 20 per cent. to 80 per cent. of gas. In 1904 one of us suggested the use of lactose instead of dextrose bouillon for the detection of the colon bacillus, and the present paper shows that out of 567 gas producing bacteria isolated from the various water supplies of Maryland, only 295 or 52 per cent. were colon bacilli, and all the rest were members of the various other groups. Dextrose bouillon was used in these tests. In order to show the comparative infrequency of organisms other than the colon bacillus, when lactose bouillon or lactose bile was used as the preliminary test we have plated out 3,752 cultures from the fermentation

* Read before the Laboratory Section of the American Public Health Association at Winnipeg, August, 1908

tube. From the lactose media the colon bacillus was isolated in 94 per cent. of cases and other organisms in only 6 per cent. When we compare 6 per cent. to 48 per cent. it is obvious that the lactose medium eliminates a large number of other gas producing types. In a comparison between lactose bouillon and lactose bile, it was found that other types than the colon bacillus were found in 12 per cent. of the tests made from lactose bouillon, and only in 5 per cent. of cases from lactose bile. The lactose bile medium, therefore, eliminates the largest per cent. of other gas forming types and it should be used when it is our purpose simply to isolate the colon bacillus and disregard other gas producing bacteria. In adding up the various percentages in which the colon bacillus was detected in glucose bouillon and lactose bouillon and bile by various authors, we find that the glucose medium gave positive results in 41.1 per cent., while the lactose medium gave positive results for the colon bacillus in 58.5 per cent. of cases. There are two distinct advantages therefore, in the use of the lactose medium, in the first place it eliminates a much larger percentage of gas forming bacteria other than the colon bacillus, and in the second place the colon bacillus itself develops in a large number of instances in a lactose medium than in a glucose medium.

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A METHOD FOR THE STAINING OF NEGRI BODIES

By D. L. HARRIS
City Bacteriologist and Pathologist, St. Louis, Mo.

Since the description by Negri in 1903 of certain bodies found in the brains of animals dying of rabies, many methods have been recommended for the staining of these structures. This is in itself evidence that all of them are more or less unsatisfactory at times. Although in most cases the Negri bodies are very numerous, large, and easily recognized, investigators are agreed that in some cases this recognition is very difficult and uncertain.

During the past eighteen months, dogs suspected of being rabid, and those killed by the police, have been sent to the laboratory of the City Bacteriologist of St. Louis for diagnosis. In the beginning of this work we were occasionally unable to demonstrate the presence of Negri bodies in animals which were proven to be rabid through inoculation tests.

In the past year we have developed an eosin methylene-blue stain which has proven so satisfactory and is so rapid and simple that I desire to report the method.

In the routine examinations, smears are made from the cornu ammonis, cerebellum, etc., between two glass slides. Two slides are preferable to a slide and a cover glass, or to two cover slips, as the thickness of the smear can be controlled more easily and there is less danger of soiling the hands. The smear is then treated as follows:

Fix in methyl alcohol one minute.

Wash briefly in water to remove the alcohol.

Immerse in a saturated solution of an alcohol soluble eosin for one minute.

Wash two or three seconds in water to remove the excess of eosin.

Immerse in a fresh solution of Unna's alkaline methyleneblue for from ten to fifteen seconds.

Wash briefly in water.

Decolorize in 95 per cent. alcohol, blot and dry in the air.

The entire process requires less than five minutes.

The structure of the bodies is more sharply defined if the smear is not allowed to dry before being fixed and stained. Smears which have dried for several days or weeks cannot be stained satisfactorily.

The older the saturated solution of eosin (alcoholic), the more rapidly and intensely it stains. A freshly made solution, or one less than two months old, will not yield the best results.

The methyleneblue (Unna's) will produce a very disturbing precipitate over the smear if it be over a week or so old. The fresher the solution the more sharply defined are the "inner" bodies.

During decolorization the slides should be examined from time to time. Decolorize until only the nerve cells are blue and the red blood cells have become bright red. It has been our experience that when the red blood cells appear red, and the nucleoli of the nerve cells a deep blue, and the protoplasm a pale blue, the Negri bodies will be seen colored a blueish red, with pronounced dark blue "inner" bodies. It is better to decolorize too much than too little. The results will be more uniform when the staining is done in staining dishes or jars.

The advantages of this method are:—rapidity, simplicity, strong contrast between Negri bodies, nerve cells and blood

cells; and the absence of a granular precipitate, so disturbing in many methods as to render the recognition of the small bodies impossible.

In the staining of material fixed in Zenker's fluid or acetone, the sections should be stained from three to five minutes in the eosin and from one to two minutes in the methyleneblue. A little practice and familiarity with the solution employed will enable one to judge correctly the time necessary for each step.

THE CO-ORDINATION OF LABORATORY WORK AND INSPECTION IN SUPERVISING THE MILK SUPPLY *

By WILLIAM ROYAL STOKES and T. M. WRIGHT
Baltimore, Maryland

The co-ordination of laboratory work and inspection is a most important matter in directing the attention of health officers to conditions which must be remedied or changed, and therefore there are various laboratory methods which direct the attention of the inspectors to dangerous conditions at various places at the source of supply or route of distribution of milk used in communities.

The colon bacillus has been frequently found by various observers in market milk, and during the year of 1907 we made 809 examinations for the colon bacillus in quantities of 1-1000 of c.c. This organism was present in 228 samples or 28 per cent. of cases.

The tubercle bacillus has also been found in milk, and our present method is to inject the entire sediment from 500 cubic centimeters into the abdominal cavity of a guinea-pig. In 179 experiments 40 per cent. lived over six weeks. These were chloroformed and killed, and sections from the liver showed typical tubercles in four cases. In the 91 animals that died of acute infection we studied the lesions microscopically and streptococci were found quite frequently in the purulent lesions of the liver, omentum and general peritoneal cavity. In six cases these were quite virulent for animals.

* Read before the Laboratory Section of the American Public Health Association at Winnipeg, August, 1908.

In 540 samples of milk examined by Slack's method we have found over 25 pus cells per field and 50.000 streptococci per cubic centimeter in 27 cases. The samples of milk were obtained directly from the railroad stations, and on following up these cases our inspectors were able to find cases of garget in fifteen cases.

The finding of colon bacilli and high bacterial counts enables us to detect careless and dirty methods on the dairy farm, and improper refrigeration in shipping the milk; careless handling in the stores and dairies can also be detected by these methods. We also hope later to send veterinarians to the farms from which the tuberculosis milk comes in order to use tuberculin in testing the herds.

EXPERIMENTS ON THE PUTRESCIBILITY TEST FOR SEWAGE AND SEWAGE EFFLUENTS*†

By D. D. JACKSON and W. A. HORTON

ABSTRACT.

A sewage or sewage effluent is putrescible if, on standing for a certain length of time, it loses all of its available oxygen. On putrescing the dissolved oxygen, nitrites and nitrates are used up and there being still an excess of organic matter for bacterial action, such action goes on under anaerobic conditions and disagreeable odors are developed. The test becomes a quantitive one when varying amounts of tap water or river water are mixed with the sample to determine the point of greatest dilution at which putrescibility occurs.

A considerable variation in the results has been obtained by using different temperatures of incubation and by the use of different indicators in the test, and the authors have made a study of the various methods employed in order to determine upon the best general mode of procedure. In this study a large number of sewages and sewage effluents of varying character have been tested under different dilutions and with several different indicators.

The methylene blue test as originally devised by Spitta removes the necessity for the use of large bottles to obtain the odor and gives practically the same results on bottles

* Read before the Laboratory Section of the American Public Health Association at Winnipeg, August, 1908

† To be printed in full in the Jour. Amer. Chemical Society.

of 250 cubic centimeters capacity taking the decolorization as an indicator of putrescibility. By the use of this indicator the 37 degree incubator can be employed to advantage. The space required is small and the time necessary for the test is only one-half that which would be taken if the bottles were kept at room temperature.

The only crfiticism of the use of the 37 degree incubator is in the leakage which sometimes occurs around the stoppers of the bottles, due to the expansion of the liquid when the temperature is raised. This loosens the stopper and may drive out some of the originally dissolved gas, and there is occasionally a backward leakage of air. The authors have experimented with various devices for preventing this loss and have found a simple and most effective arrangement. The test is made by replacing the ground glass stopper of a 250 cubic centimeter bottle by a perforated soft rubber stopper through which is a small glass tube or medicine dropper having a large-sized heavy rubber cap tightly attached to the end. The tube is drawn out like the usual medicine dropper and when in position extends in to the liquid in the bottle. A measured amount of the colored indicator is placed in the bottle, which is then completely filled with the liquor to be tested. The dropper is then also completely filled with the liquid, making sure that no air bubbles are left. The tube which extends through the stopper is placed in position and the excess of water pressed out between the bulb and the top of the tube, leaving the bulb in a collapsed state.

When placed in the incubator the bulb will partially fill, due to the expansion of the liquid and the giving off of some gas previously in solution. By this method the expanded water and all gas bubbles are held back and there is no loss of the original water or air in solution, and no backward leakage of air from without.

All of the indicators used were found to be slightly anti-

septic, so that it is best to employ the indicator in amounts as small as is possible to obtain a distinct color. These amounts are, in the case of methylene blue and methylene green, one cubic centimeter of one-twentieth of one per cent. solution for each bottle of 250cc capacity, and for indigo carmine, one cubic centimeter of a one-tenth of one per cent. solution.

It was thought possible that medicinal methylene blue, which is the chloride free from zinc, might be a better indicator than the common methylene blue, which is the double zinc salt. This latter salt is the coloring matter which has been generally used for the putrescibility test.

Our experiments show, however, that the medicinal methylene blue is not as delicate an indicator as the double zinc salt or commercial variety, and that the methylene green is slightly more delicate than the commercial methylene blue.

These differences are probably due to molecular construction. The zinc salts would tend to be more easily broken down under anaerobic conditions and the methylene green would have a greater tendency to be acted upon as it is a mono nitro derivative of methylene blue, and for this reason may be considered to have a slightly weaker point of attack.

In treating undiluted sewages with these three indicators the methylene green was always decolorized first, then the common methylene blue, and finally the medicinal methylene blue. This shows clearly the degrees of delicacy of the three indicators.

The indigo carmine was usually last to be acted upon, but this was not always the case. There seems to be much variation in the action of this indicator, depending upon the nature of the sewage or effluent employed. There is also great variation in the salt itself as found on the market,

as it is composed of indigo sulphonic acids and their salts of greater or less purity.

In waters containing much suspended inorganic matter, it sometimes happens that the coloring matter is precipitated or dragged down to the bottom of the bottle and the liquid above becomes colorless. Such a result should not be mistaken for putrescence, as when the bottle is shaken the indicator will become suspended and will not be shown to have been decolorized.

Some authors have criticized the indicator test as giving positive results at times when no disagreeable odor is developed. It is probable than in such cases the air is entirely used up in the bottle, but the excess of organic matter is not sufficient to develop a much further increase in bacterial action, so that while anaerobic conditions exist, the odor does not sharply indicate the fact. In at least one case the odor of such a sample was obtained by incubating a gallon bottle and then pouring out a portion of the liquid and shaking the bottle. In this case a strong odor became evident, which would otherwise have been undetected.

CONCLUSIONS.

1. The test for putrescibility, if made by taking the odor, requires bottles of large size and an incubator space too great to be practical. As the bottles must be completely filled with the sewage or effluent and can not be shaken except at the end of the test, a comparison of the time required to become putrescible can not be readily made. The delicacy of the test in general is not as great as by the use of color indicators.

2. The test is best made in bottles of 250 cubic centimeters capacity, having a perforated rubber stopper, in which is inserted a medicine dropper with a tight rubber bulb. This bulb compensates for any change in volume

due to the expansion of the liquid, thus preventing loss of water or previously dissolved gas and any access of air.

3. The test should be made in an incubator at 37 degrees C., using the double zinc salt of methylene green as an indicator, and the results taken at the end of four days. This should be considered the standard, but in sewage laboratories, where only rough tests are required, the room temperature may be used, in which case eight days may be taken as the time of incubation.

4. The amount of methylene green used should be one cubic centimeter of a solution containing one-half a gram per liter. Larger amounts of this, as well as of methylene blue, have a slight antiseptic action.

5. The comparison of the relative putrescibility by dilutions of sewages and effluents is a very valuable test of the various methods of sewage treatment. It not only tests the work accomplished by purification plants but gives data as to the amount of dilution necessary to prevent foul odors in the final disposal of a sewage or effluent which enters a stream or other body of water.

THE RESULT OF REINCUBATION AND REINOCULATION OF ATYPICAL DIPHTHERIA CULTURES*

By B. R. RICKARDS, F. H. SLACK and B. L. ARMS
Boston Board of Health Laboratory

A Preliminary Communication.

The diphtheria diagnostician recognizes the fact that in his work he meets with a small and fairly constant percentage of cultures for diagnosis showing only irregular or atypical forms, which cannot honestly be reported as either positive or negative. There are of course many cultures which would be considered doubtful by a person unskilled in diagnostic work whch by the skilled diagnostician would be readily relegated to either the positive or negative class; these are not considered here, but we have special reference to what might be called the border-line cultures, containing suspicious forms only, which from peculiarities of morphology, grouping, or staining indicate the presence of the Klebs Loeffler bacillus.

It is urged by some that the diagnostician should always give either a positive or negative report on cultures submitted for examination, and in some ways it might be advantageous to be able to do this; but the laboratory expert who wishes to gain and keep the confidence of the community will best do so by giving honest reports.

It has been the custom of this laboratory to report such

* Read before the Laboratory Section of the American Public Health Association at Winnipeg, August, 1908

cultures to the physicians as "suspicious," and request that other cultures be submitted.

The average practitioner receiving such a report quickly submits the requested second culture, isolates the patient, if this has not been already done, and gives antitoxin. The patient and his family have the advantage then, if the case is positive, of as complete protective treatment as if the first culture had been reported positive, while if the case proves negative he is saved the disadvantage of having been sent unnecessarily to the contagious hospital.

It is of great advantage to physicians in these cases where the diagnosis is delayed to obtain as early a return as possible from the cultures submitted, and if by further work with the primary cultures a quicker report can be sent, this is desirable.

One of us* has previously called attention to the fact that longer incubation or reinoculation sometimes throws new light upon atypical cultures, and that while, as a usual thing, 15 hours' incubation is sufficient for demonstration of *B. diphtheriae* if present, there are occasional cultures possibly containing antagonistic forms of bacteria, for which longer incubation is to be preferred.

In this paper are presented the results of reincubation and reinoculation of 242 such cultures encountered in our routne work from September, 1907, to July, 1908. During this period reports were given on 10,217 cultures, 7,850 beng reported negative, 2,125 positive and 242 suspicious. These suspicious cultures received the usual 15-hour incubation. After being examined and reported "suspicious," the original tube and a transplant on fresh serum were placed in the incubator between 10. A. M. and noon, excepting Saturdays, Sundays and holidays, when cultures were not returned to the incubator until the routine cultures went in at 6 P. M.

* Rickards, Am. Jour. of Pub. Hygiene, Aug., 1908.

Those cultures which were placed in the incubator before noon were examined at 5 P. M., and all cultures were examined at nine o'clock the following morning.

Of the 242 cultures containing suspicious looking organisms, 12 proved to be positive, either from these or subsequent cultures; no subsequent cultures were received from 22 of this number, the majority of the patients being sent to the contagious hospital at once on account of clinical symptoms and the "suspicious" report.

Of the 122 which were not proven positive culturally no subsequent cultures were sent from 40 cases, a part going to the contagious hospital, others clearing up so rapidly that another culture was not considered necessary by the attending physician.

TABLE NO. I.

Summary of Reincubation and Reinoculation in Positive Cases Comparing the Original Tube with the One Inoculated from It and the Subsequent Culture When One Was Received.

Reincubation of original culture was positive at 5 P. M. in 17 instances.

Reinoculation from original culture was positive at 5 P. M. in 16 instances.

Reincubation of original culture was positive following A. M. in 60 instances.*

Reinoculation from original culture was positive following A. M., in 58 instances.*†

Subsequent culture positive in 79 instances.

TABLE NO. II.

Reincubation was positive and reinoculation negative in 20 cases.*

* Apparent discrepency is not a real one as in a few instances original tube was positive at 5 P. M. but negative in the morning having been completely overgrown.
† No 5 P. M. examination made on 15 of above.

Reincubation was negative and reinoculation positive in 16 cases.*

Both were positive in 43 cases.

Both were negative in 41 cases.

TABLE NO. III.

Reincubation or reinoculation or both positive; subsequent negative, 16.

Reincubation or reinoculation or both positive; subsequent positive, 41.

Reincubation and reinoculation or both positive; no subsequent, 22.

Reincubation and reinoculation negative; subsequent positive, 41.

CONCLUSIONS.

1. These findings demonstrate conclusively the value of further work with atypical cultures.

2. As from the 242 cases, 120 came positive while 82 were proven negative, the chance of error, had a positive or negative result been reported at the end of the 15-hour examination, would have been great.

3. Both reincubation and reinoculation tests should be made as in a fair percentage of the cases but one of these cultures proved to be positive.

4. As in many instances a positive result was obtained after but five to seven hours' additional incubation, it is an advantage to make the 5 o'clock examination that the physician may have his report at the earliest possible moment.

5. It would appear that typical diphtheria bacilli may be so overgrown at the end of the ordinary 15-hour incubation as to practically disappear, the few remaining forms being atypical; this same culture or a transplant giving abundant typical forms on further incubation.

* Apparent discrepency is not a real one as in a few instances original tube was positive at 5 P.M., but negative in the morning having been completely overgrown.

6. The diphtheria diagnostician must recognize in dealing with cultures for diagnosis that the associated organisms may be either symbiotic, neutral or antagonistic, and that while in a large percentage of the cases the diphtheria bacillus may be relied upon to outgrow the other organisms in 15 hours' incubation, there are a small number in which the associated organisms obscure the result at this time, the diphtheria bacillus appearing in large numbers either on shorter or longer incubation periods, depending on the nature of the growth of these organisms.

REPORT OF THE COMMITTEE ON STANDARD METHODS FOR THE EXAMINATION OF AIR*

The entire question of air examination,—physical, chemical, and bacteriological,—is in a highly undeveloped state. There are admirable methods available for the determination of temperature and humidity; and certain methods used in the analysis of air for carbon dioxide are of high accuracy. The estimation of dust particles and the enumeration of bacteria are, at present, on a less satisfactory basis. All along the line are differences of opinion as to the trustworthiness and limits of usefulness of particular procedures. There is no agreement as to the significance of the results obtained by a given method, and in some cases no standards are available for the interpretation of results. It is essential to the progress of that branch of sanitary science which deals with the atmosphere that these conditions should be remedied. Fundamental laboratory methods of high accuracy, and alternative simpler methods for practical use are urgently desired; the latter are as necessary as the former, but they should be standarized by the former, so that the extent of possible errors may be understood. The Committee has at present limited itself to a general review of existing methods of air examination, touching upon the following points:

A. Physical Determinations.

The most important properties of air, from the sanitary standpoint, are physical, rather than chemical or bacteriological. Disease bacteria may be carried at times by the air, and organic compounds, obvious to the senses, are unpleasant and perhaps dangerous. The commonest evil effects of bad ventilation are due, however, to high tempera-

UNIVERSITY OF ILLINOIS

* Read before the Laboratory Section of the American Public Health Association at Winnipeg, August, 1908

ture, high relative humidity, and dust. It is these points which particularly deserve careful and extended study.

1. Temperature and Relative Humidity. High temperatures and high relative humidity are recognized as the chief causes of discomfort in ill-ventilated rooms, aside from conditions which obtain in special industrial processes. These two determinations are therefore of prime importance in sanitary work. A calculation of the dew-point is often useful in addition to the temperature and relative humidity.

There are a number of reasonably accurate methods for determining the temperature and humidity of the air. Of these the sling psychrometer is the most accurate, but several forms of stationary wet and dry bulb thermometers are reasonably satisfactory for practical purposes.

2. Amount and Character of Dust. The common method of estimating dust in the air is to draw a measured volume of air through a filter of some sort and to determine the subsequent increase in weight. Soper suggests a filter of sugar, the sugar being subsequently dissolved and the dust filtered and weighed in a Gooch crucible. The number of dust particles present in air can be determined by Aitken's koniscope, which depends on the cloudiness produced by exhaustion of the air in a vacuum tube.

B. Chemical Determinations.

1. Carbon Dioxid: Numerous efforts have been made to develop methods of analyzing air for carbon dioxid, applicable to the varying conditions under which the inspector or sanitary engineer must work. Much remains to be done, however, in making these methods more exact, and in forming and in developing a logical and conservative basis of interpretation for the results obtained. In the great majority of cases the important comparison is between well and badly ventilated spaces. Other variables, such as temperature, humidity, and dust, of course affect the practical result. For the determination of carbon dioxid, working limits of

.2 to .3 parts per 10,000 with a possible maximum error of .5 parts gives a sufficient degree of accuracy. The ideal method is one which yields results as reliable as this rapidly and with easily portable apparatus.

The collection of the sample presents almost as many difficulties as the subsequent determination of the carbon dioxid contained therein. Samples may be successfully collected by a water syphon, by the use of a glass sampling cylinder fitted with a tight piston, or perhaps best by the steam vacuum method in which the sampling bottle is filled with steam by inverting over a boiling flask of water and when full of steam is stoppered with a vaselined rubber stopper. The sample is collected simply by removing the stopper.

For the final determination of carbon dioxid the Cohen and Appleyard method seems most satisfactory.

In regard to organic matter it is certain that in crowded rooms decomposing organic matter may be present, in such amounts as to affect the sense of smell and to produce serious temporary effects upon comfort and physical condition. No chemical methods are available, however, for the detection of the particular sorts of organic matter which are associated with such unpleaant sensations. The inspector may place considerable weight upon the evidence of his own senses in this regard. Air which smells bad is bad, for the reason that it smells bad. No analysis may be capable of showing its unpleasant condition; yet a trained investigator may be able to ascertain the cause of the unpleasant odor as soon as he encounters it.

C. Bacteriological Determinations.

1. Total Number of Bacteria. Very little has been done in late years in the study of methods for the determination of the number of bacteria in air. Most recent observations have been carried out by some modifications of the filter method suggested by Petri in 1888, or by the simple expo-

sure of plates of solid culture media. The latter procedure of course determines only the number of bacteria which fall on a given area in a given time rather than the number of bacilli present in air. Winslow has recently suggested a new method which consists in drawing a measured volume of air into a large bottle and allowing the bacteria to settle out on a layer of nutrient medium at the bottom. Comparative tests with this method and the sand filter method show that the filter method is reasonably accurate, if the sand grains be less than .3 of a millimeter in diameter, and the sand method is more convenient for work outside the laboratory than the culture bottle method. Weinzirl has obtained good results by bubbling air through a normal salt solution in a U-tube with a bulb at the distal ed.

2. Isolation of Specific Forms. The culture bottle method has been used with success for the isolation of sewage bacteria from air, measured samples of air being drawn into bottles containing dextrose broth, from which Bacillus coli and the sewage streptoccus may later be isolated.

It should be noted that the presence of acid-forming streptococci in air is of particular importance, since Gordon has shown that these organisms may be used as a measure of mouth pollution in inhabited rooms.

D. Conclusions.

This preliminary report is necessarily of a tentative and general nature. The Committee wishes, during the coming year, to collect such data on the details of various methods and their comparative value that a definite scheme of standard methods may be presented for the consideration of the section at the Richmond meeting. Such a scheme would naturally be left in the hands of the members of the section for a year more, before final adoption.

During the present year, the members of the Committee hope to carry out comparative tests of various procedures as far as time permits, but the assistance of other members

of the section is essential to success. In particular the Committee wants suggestions as to new methods, or details of procedure, or statements as to preference between alternative methods. This information is needed in the immediate future, as the work of the Committee must be completed by the summer.

C.-E. A. WINSLOW,
ELLEN H. RICHARDS,
JOHN WEINZIRL,
J. BOSLEY THOMAS,
G. A. SOPER.

Vital Statistics Section

PLURAL DEATHS IN FAMILIES AS AN INDEX OF THE FATALITY OF DISEASE *

By CHARLES V. CHAPIN, M. D.
Registrar of Vital Statistics, Providence, R. I.

It is very desirable from an epidemiological standpoint to determine whether the contagious diseases vary in virulence from year to year, and if so to what extent. For this purpose, case fatality rates are not usually very satisfactory. Thus the registration of the infectious diseases has been in vogue for only about twenty years or so, and yet it is desirable to know the true fatality as far back as mortality statistics have been preserved. Again, there is reason for believing that the registration of sickness has become progressively more and more complete. This, for instance, I suspect is illustrated by typhoid fever statistics in Providence. The apparent fatality of this disease was 51.0 in the years 1884-1887, the high fatality due probably to the failure to report cases. During the next five years, owing to attention drawn to this disease by pollution of the city water, the returns were more complete, and the apparent fatality was 30.4. During the five years, 1896-1900, the fatality was 23.7, and during the last five years 19.1. The use of the blood test has, I believe, done much to bring about the recognition of mild cases which formerly were not considered typhoid. It is possible then that the apparent fatality of this disease is no

* Read before the Section on Vital Statistics of the American Public Health Association, at Winnepeg, August, 1908

indication of its virulence, but the decrease may be due entirely to better diagnosis and better registration.

It occurred to me that in the absence of any better method, the frequency with which more than one death occurred in a family might be taken as an indication of the severity of a disease. It would seem that when a disease assumes a fatal form, plural deaths in a family ought to be more frequent than when the type is mild. But of course other factors do not always remain the same. Thus the size of the family may change. But such changes are usually quite small. Again improved isolation or removal to the hospital may prevent the spread of the disease. The influence of better isolation in the family in the majority of cases is not. very great, and the influence of removal to the hospital can be calculated. Also improved treatment may have lessened the fatality as has undoubtedly been the case in diphtheria during the last dozen years.

An opportunity was afforded recently, in Providence, of testing the value of plural deaths as an index of virulence. For a number of years the fatality of scarlet fever had been low, as it has in most places. But, in the latter part of 1906 an outbreak began, at first confined to Italians, which showed a much higher virulence. For the nine years preceding 1906, during which the fatality was low, the average rate was 3.4, while in 1906 and 1907 it was 12.5; and during the six months when the outbreak was at its height, the case fatality was 17.2. Strangely enough, the fatality was rather lower among the Italians than among the other elements of the population.

During the years 1906-07 there were 17 instances where there were two deaths in a family, and four instances where there were three deaths, making in all 21 secondary or plural deaths. This was 11.8 per cent. of the 178 deaths. During the preceding nine years there were seven plural deaths or 4.7 per cent. of 149 deaths. The increase in fatality as

indicated by the plural deaths was from 4.7 to 11.8, while the increase as indicated by the case fatality was from 3.4 to 12.5. This seems to show that the number of plural deaths furnishes a crude, but only a crude means of estimating the severity of a disease. Perhaps if the figures were larger the correspondence might be closer. In 1887 the case fatality was high, being 18.04, and the percentage of plural deaths was 8.5. The case fatality was higher and the proportion of plural deaths lower than in 1906-7. But I know that cases of this disease were not nearly as well reported in 1887, and it may very well be that the disease was really not as virulent in 1887 as in the later outbreak. The mortality from scarlet fever was higher in 1856 than in any other year, there being 144 deaths, or 295 per 100,000 living. Of these 144 deaths 13, or 9 per cent., were plural. If our index is worth anything, it shows that in 1856 the excessive mortality was not due to excessive virulence but to an enormous prevalence of the disease.

During 1893-95 the case fatality of diphtheria and croup was 46.6 and the percentage of plural deaths 7.8. During this time the use of cultures and antitoxin had done almost nothing in Providence to affect the registration of the disease or to decrease the mortality. In 1896 the case fatality fell to 16.47, and the percentage of plural deaths to 6, changes probably due to the use of cultures and antitoxin. During the past seven years the case fatality of diphtheria has been 11.4 and the percentage of plural deaths 1.5. The fact that the ratio of plural deaths fell faster than the case fatality may be explained in two ways. It may be that the use of cultures has really cut down the volume of registration by eliminating follicular tonsilitis, etc., as some assume, but as seems to me improbable. And it may be that when a family has lost one child from diphtheria the effective administration of antitoxin to the others prevents secondary deaths.

In 1877 and 1878 there was an extensive outbreak of diph-

theria, the mortality being 332 and 278 per 100,000 living. The percentage of plural deaths, however, was 10.6, about the same as in the years immediately preceding the use of antitoxin. This seems to indicate that the excessive mortality in former years from diphtheria, as from scarlet fever, was not due to excessive fatality but to excessive prevalence, perhaps the result of the neglect of isolation.

ON THE LIMITATION OF THE APPLICATION OF THE THE CRUDE DEATH RATE IN DETERMINING THE HEALTHFULNESS OF LOCALITIES*

By S. J. BYRNE, M. D.
New York City

Before attempting, on the basis of the crude death rate, to pass judgment on the healthfulness of any particular locality, be it a village, city or rural community, we must first take into consideration the component parts that make up the population of that special territory, and the efficiency of the registration of deaths occurring therein.

We must first understand that the crude death rate alone is practically of little value. It becomes, therefore, necessary to put a limitation to its application. This limitation is based on the knowledge we may have or are able to obtain of the population with which we have to deal, and the conditions in which they live, as, for example, it would be manifestly unfair to pass judgment on the death rate of a city on the same basis on which we would accept the rate of a rural district, there being in the first case many occupational and other conditions that tend to shorten life that do not exist in the latter. It would likewise be well to remember the important part played in certain districts by large hospitals and sanitoria at certain localities. These localities are selected especially on account of their salubrity, and still the crude death rate would lead us to believe them very unhealthful, due to the fact that many who come to seek health delayed their search

* Read before the Section on Vital Statistics of the American Public Health Association at Winnipeg, August, 1908

too long, and thus added their large proportion to make a high death rate for a district otherwise exceptionally low. The effect of hospitals on the rate of a locality is well exemplified in the case of the old town of Flatbush. In this town, which showed an extremely low corrected rate, the crude rate was exceptionally high, due to the fact that the County Hospital, Almshouse and Contagious Disease Hospital, whose inmates practically all came from Brooklyn, were located within its borders, and the deaths within these institutions were charged to this otherwise healthful suburban territory. We should also place a limit on account of occupational conditions adding to the hazard of life and health and the class of population, whether made up largely of children or adults. Generally speaking, high birth rates are coincident with high death rates, on account of the high infant mortality, which raises the general rate, for with few exceptions we find a high rate of mortality among infants in all countries having a high birth rate. We should, however, remember that while a falling birth rate will materially affect the rate of mortality for the time being, on account of the smaller number of infants under a year old, among whom a high death rate is always to be expected, either on account of congenital defects or want of care and proper nourishment, later on this same falling birth rate will reduce the percentage of those who would be liable to reach the ages where ordinarily we expect low death rates to prevail, thereby increasing the rates not only at those particular ages, but the whole death rate as well.

We thus come to the conclusion that in eliminating these principle palpable causes, which have no bearing on the salubrity of localities, we must take these same causes into consideration and seek to find what bearing, if any, they have in the formation of crude rate, before passing judgment on the healthfulness of a particular locality.

Added to this limit, we must not overlook the all-impor-

tant question of thorough registration. Without proper registration all judgments based on crude death rates are mere guesses. In this respect I believe that every State legislature should be brought to see the importance, and I might add, necessity, of efficient and thorough registration of births and deaths, in conformity with a plan adopted by the General Statistical Office of the United States at Washingon after advisement with the representaitve statisticians of the various cities and states.

MORTALITY STATISTICS IN CANADA DURING THE PAST DECADE*

By CHAS. A. HODGETTS, M. D.
Chief Health Officer and Deputy Registrar General, Ontario

Naturally the decade chosen as the one for discussion in this paper is that intervening between the last two Dominion census, namely, for the years 1891 and 1901, when the population was found to be as shown in the following table:

POPULATION	1891	1901	Percentage increase or decrease of 1901
Total of Canada -	4,833,239	5,371,315	11. 1
British Columbia -	98,173	178,657	81. 9
Manitoba -	152,506	255,211	67. 3
New Brunswick -	321,263	331,120	3.06
Nova Scotia -	450,396	459,574	2.03
Ontario -	2,114,321	2,182,947	3. 2
Prince Edward Island	109,078	103,259	—5. 6
Quebec -	1,488,535	1,648,898	10. 8
The Territories -	66,799	158,940	130. 8
Unorganized Territories	32,168	52,709	63. 8

The increase for the Dominion as a whole was 11.1, the minimum increase being in Nova Scotia, 2.03 per cent,. and the maximum in the Territories which have since been made into Provinces, the tide of immigration being thither-

* Read before the Section on Vital Statistics of the American Public Health Association at Winnipeg, August, 1908

ward, while Prince Edward Island shows a decrease of 5.6 per cent.

As the system of classification of causes of death in the last census is that of Bertillion, the figures given permit of ready comparison with other countries where this is used. Regarding the completeness of the returns for 1901, the Chief Commissioner, Mr. Blue, states (Page 228, Vol. IV.) "It is well recognized that mortality returns of a census are never full. They are often ten per cent. or more below the actual deaths, as verified by local registration and other sources of information. Indeed no method of procuring mortality statistics is quite satisfactory," which statement is freely admitted, and continuing, the Commissioner gives his experience in respect to registration figures in Ontario, having compared carefully name by name those returned to the Registrar General of the Province with those collected by the census officers. The result of this painstaking comparison, as stated in the report, is briefly as follows: "For Ontario the comparison was very carefully made, name by name, and after striking out duplicates and the still-born, the total mortality for the census year in a population of 2,182,947 was ascertained to be 33,272. This is 6,243 more than the returns made by the census enumerators, and 3,244 more than the provincial records show, exclusive of still-born." The death rate for Ontario is 15.24 per 1,000. By reference to the census districts, page 230 and 231 of the Report, it is found that the discrepancies found ranged from 9 in the County of Frontenac to 391 in the City of Ottawa, while for the three districts comprising the City of Toronto they were—Centre, 145; East, 276; West, 327, respectively, or a total increase of registration over census returns of 748.

From this interesting comparison it is quite evident that in Ontario there were in the Census year, 3,244 deaths occurring which had not been registered with the Division

Registrars, as required by law. Naturally one would expect to find that the greatest discrepancies would have been noted in the less sparsely populated districts, where the Division Registrars are more inaccessible, and where small private burial grounds are often used, but of the total 3,244, the unregistered deaths in the large cities were as follows:

Toronto	748
Hamilton	194
Kingston	89
London	115
Ottawa	391

Showing that in the four principal cities of the Provinces, where the Medical Health Officer was authorized to vise every certificate of death before the permit for burial could be issued by the City Clerk, there was a discrepancy in the census year of 1,537 or 47.3 per cent. of the total number of discrepancies.

Carrying these figures for 1901 through the decade, it may be roughly estimated that there were at least 30,000 deaths which were not registered, and this in a population of less than two and one-quarter million, where registration has been in force since 1869, and there are nearly 900 divisional registration offices.

I say nothing of those provinces where the work is not so complete, but leave the reader to estimate the total number of unregistered deaths in the Dominion for the ten years, 1891 to 1901.

With the object to correct, if possible, this large discrepancy in the mortality returns of Ontario, the Vital Statistics Act, 1908, provides fully for the notification by medical practitioners of each death forthwith to the Division Registrar, and, where necessary for the convenience of the public, the Registrar General appoints sub-registrars, who are authorized to register the death—grant a certificate of reg-

istration or burial permit, forwarding, however, the original return to the Registrar of the Municipality or Division in which the death occurred.

A further provision is also made for the making of returns of all deaths quarterly to the Registrar General by all Registrars and sub-registrars, together with the original forms as received by the former. The cemetery authorities have also to make quarterly returns to the Division Registrars, who in turn forward them to the Registrar General, and, to complete the chain, legislation enacted in the Act respecting cemeteries will require that they must register with the Register General the name of the responsible party who is to make the quarterly returns, and, further, it will be made a punishable offence to bury in any cemetery or burial ground not registered in this manner. And in addition to these provisions I would urge the registration of all persons engaging in the business of an undertaker, requiring them to make quarterly returns of all burials made during the previous three months—and making the continuance of licenses largely dependent on their making returns to Division Registrars.

A study of the tables of deaths—numbers 1, 2 and 3, shows clearly that a great accuracy has been obtained throughout the whole Dominion in the registering of the correct cause of death. The number registered as of ill-defined causes in 1891 was 10,389, or 15.3 per cent. of the total, whereas in 1901 the number fell to 1,337, being a decline of 87.1 per cent., or only 1.6 per cent. of the total, which were really unstated or unclassified.

Of the other thirteen classes of diseases, the only one in which a decrease is noticeable is that of diseases of the Respiratory System, the decrease in 1901 being 13.1 per cent., the proportion being about equal for both sexes.

Of the groups showing an increase, the most marked was that of malformations, only four being given in 1891,

while in 1901 the figures were 254. Your attention is also directed to the increase in groups 11 and 12, where at the extremes of life it was found that in infancy the increase was 221 per cent., while that for old age was only 39.3 per cent. The latter is perhaps a natural thing, but the former clearly indicates in this country the slaughter of the innocents continues—a fact which clearly shows that women should be educated in their duties of motherhood before they enter upon these responsible duties, else forever we must look for a large death roll amongst the first-born of young Canadians as due to congenital debility, for while only 47 were directly attributable to neglect, yet upon the tombstones of the most of the remainder could be honestly written—"Due to ignorance on the part of the mother as to how to properly carry a child." No reference is here made to deaths occurring in the first year of life from other causes.

Any extended table of the classification of deaths by causes for the two years under consideration is not deemed necessary, chiefly from the fact that considerable discrepancy exists in the tables as adopted in the two years, that for 1891 being very incomplete as compared to the International which has been adhered to in 1901.

The following are a few of the interesting points found in the report and, for convenience, these will be discussed in the order of groups as given.

GROUP I.

Naturally, as a sanatarian one gathers up in this group the figures in reference to communicable diseases. For the six most common they are as follows:

	1891	1901
Diphtheria -	3,356	3,206
Measles -	794	1,029

Scarlet Fever	-	546	1,101
Smallpox	-	11	45
Typhoid Fever	-	1,592	1,909
Whooping Cough	-	756	1,086

In all of which diseases it will be seen there was an increase in 1901, with the exception of Diphtheria (including Croup,)—a condition which in the writer's opinion should not exist as regards Typhoid Fever, Scarlet Fever and Smallpox, if health authorities were fully alert to their duties.

THE AGES AT DEATH ARE SHOWN IN THE FOLLOWING TABLE

Age Group	Diphtheria	Measles	Scarlet Fever	Smallpox	Typhoid Fever	Whooping Cough
Under 1 year	677	334	159	6	59	678
1 to 4	1525	490	600	10	139	366
5 to 14	872	128	304	2	261	37
15 to 24	80	36	24	6	556	5
25 to 34	22	3	5	6	350	—
35 to 44	10	5	5	4	239	—
45 to 54	3	10	2	5	142	—
55 to 64	4	7	—	2	84	—
65 to 74	8	9	2	1	42	—
75 and over	2	1	—	2	21	—
Not given	3	—	—	—	16	—
TOTAL	3206	1023	1101	44	1909	1086

While Diphtheria carried off 95.8 per cent. before they reached the fifteenth year of life, yet the table shows that even those of the most advanced age group were not immune. Similarly Measles was most fatal in the same age groups, 93.1 per cent. dying before the fifteenth year of life, and a similar condition was found in reference to Scarlet

Fever, the percentage of deaths being 96.5 for the same age groups. The maximum number of deaths in each of these diseases occurred in the group 1 to 4 years, while in the case of Whooping Cough 62.4 per cent. of the deaths were reported in the first year of life, and none occurred after the 24th year of life.

Typhoid Fever claims victims at all ages, the smallest number, 21, being of the age "75 and over," and infants under one year to the number of 59 succumbed to it. The maximum was reached in the group 15 to 24 years, 29.1 per cent. of all deaths being from this disease.

The number of deaths from Cancer increased in the decade 91.2 per cent., 1,188 being reported in 1891 as against 2,272 in 1901. The distribution throughout the age groups is as follows:

Under 1 year	-	—
1 to 4	-	5
5 to 14	-	7
15 to 24	-	21
25 to 34	-	60
35 to 44	-	217
45 to 54	-	422
55 to 64	-	611
65 to 74	-	588
75 and over	-	337
Not given	-	4
	TOTAL,	2272

showing a gradual increase from the group 1 to 4 years until the 35 to 44 years group is reached, when the deaths were more than three times as many as in the preceding age group, the maximum occurring in those of the ages, 55 to 64. One-third of all the deaths, however, happened before the age of 55. The more extended study of Cancer

in the Dominion is certainly most important, and the governments should take up the question at an early date.

Tuberculosis of all forms caused the death of 2,220 more persons in 1901 than in 1891—a condition of affairs certainly worthy of the serious consideration of not only the Provincial Governments, but of the Federal legislators. In this relationship it would be interesting to know what percentage of this number of persons were recent immigrants to the Dominion. The most fatal period of life was that from 15 to 24 years, and 5,897 or 60 per cent. of the total number were of the ages, 15 to 44 inclusive.

Under 1 year	-	564
1 to 4	-	629
5 to 14	-	759
15 to 24	-	2512
25 to 34	-	2110
35 to 44	-	1275
45 to 54	-	828
55 to 64	-	543
65 to 74	-	349
75 and over	-	116
Not given	-	24
	TOTAL,	9709

The distribution of this disease in Canada is shown in the following table.

Tuberculosis in	British Columbia -	286
" "	Manitoba - - -	382
" "	New Brunswick - -	539
" "	Nova Scotia - - -	911
" "	Ontario - - - -	3544
" "	Prince Edward Island -	224
" "	Quebec - - -	3373
" "	The Territories - -	400
" "	Unorganized Territories -	50
	TOTAL,	9709

The deaths from affections of the nervous system are upon the increase, the numerical increase being males,

1,340 and 1,362 amongst females, 4,014 of the deaths happening in children under five years of age.

GROUP III.

The increase with this group has been much less than in No. II, that of males being 808 and females 822 over 1891.

GROUP IV.

Owing to the very imperfect classification adopted in 1891, it is impossible to make any intelligent comparison of the various diseases. Apparently the deaths from pneumonia were recorded under Congestion and Apoplexy of the Lung, and where Pleurisy was placed is very difficult to say. It is gratifying, however, to note the decrease in deaths from diseases of the lungs and respiratory system, the decline for both sexes being 1,538.

The mortality in children under five years of age is marked, the deaths totaling 4,140 or 40 per cent., and of this number, 1,859, or 44 per cent., were due to pneumonia. Those of the remaining age groups until the 65th year of life is reached vary but slightly, 2,389 or 23 per cent. happening after this latter age, and of these elderly persons, 57 per cent. died of pneumonia—in all 5,679 deaths attributed to diseases of the respiratory passages were victims of pneumonia by slightly over 55 per cent.

	Diseases of Respiratory System	Pneumonia
Under 1 year	2398	1001
1 to 4	1742	858
5 to 14	590	302
15 to 24	532	373
25 to 34	473	361
35 to 44	535	375
45 to 54	629	447
55 to 64	823	557
65 to 74	1165	709
75 and over	1224	657
Not given	52	39
TOTAL -	10163	5679

It is not possible to make any comparison showing the months in which any of the diseases of this group were most fatal, but doubtless the severity of our winters has considerable bearing thereon.

GROUP V.—Diseases of the Digestive System.

The increase of the group of diseases for the decade was 31.3 per cent., and of the total number in 1901, 5,738, or 56.4 perc ent. were infants under one year—and 5,170 of this total were due to cholera infantum, caused no doubt mainly by improper feeding, chiefly something wrong with the milk which enters almost exclusively into the dietary of children of this age—figures which should be and could be reduced if health authorities were empowered to deal more forcibly with the question of a pure milk supply.

GROUP VI.

The incompleteness of the 1891 classification here again prevents of comparison being made except in so far as the total number of deaths is concerned, the increase being from 1,133 in 1891 to 2,123 in 1901. The deaths from Bright's Disease in the latter census were 658 males and 334 females—nearly one-half the group total.

GROUP VII.

With the improvements in the methods of ascepticism it is certainly a regretable fact that puerperal septicaemia does not appear in a better position than it does. The reflection is upon hygiene whether as followed out by the physician, the nurse or the public, I cannot say, but an increase in deaths from 70 in 1891 to 342 in 1901 is decidedly higher than it should be. In the age group of women under 15 we find 3 deaths recorded—while 17 were 45 and under 54, and one of the reputed age of 55 to 64 died of puerperal septicaemia.

Passing over the Groups VIII, IX and X, which call for little notice, we come to Group XI. This group relates

chiefly to deaths amongst the infantile population which are not classified elsewhere, and it affords a fitting opportunity for a brief consideration of this important aspect of the mortality returns. In Table No. will be found the deaths of infants under one year throughout Canada, by Provinces for the year 1901, under the different groups of causes of death.

The chief cause of death in the several individual diseases were as follows:

Measles - - - -	334
Whooping Cough - - -	675
Diphtheria and Croup - -	677
Influenza - - - -	460
Tuberculosis in all forms -	546

These being of the Communicable group. In the latter class, the males were 240 and females 306.

In GROUP II.—Simple Meningitis, 727 males and 550 females—a total of 1,277.

Convulsions—males 628 and females 473—a total of 1,101.

In GROUP IV.—Acute Bronchitis—males 261, females 132—total of 393.

Broncho-Pneumonia—256 for both sexes—and Pneumonia—891 for both sexes.

In GROUP V.—Cholera Infantum—5,170 for both sexes.

In GROUP XI.—There were 5,645 deaths of infants due to Congenital Debility, icterus and sclerema, and 580 to other diseases peculiar to infancy, and 43 of neglect, while

In GROUP XIII.—323 were reported as due to starvation or want of breast milk.

For the Dominion in the year 1901, of the total number of males dying (42,576,) 12,026 or 28.2 per cent. were infants under one year, and of the total of females dying, (38,625), 9.302 or 24.0 per cent. were under one year of age.

The Provinces with the largest number of infantile deaths, Ontario and Quebec, are represented in the following figures:

		TOTAL
1891	Ontario—2993 males and 2336 females	5229
	Quebec—5613 " " 4400 "	10013
1901	Ontario—3740 males and 2957 females	6697
	Quebec—6523 " " 4926 "	11449

As the total numbers of both sexes who died in these years were 18,569 in 1891 and 21,328 in 1901, the percentages of the total number of infantile deaths for these Provinces for the two periods are as follows:

1891 Ontario—28.1 per cent.
1901 Ontario—31.4 per cent.
1891 Quebec—53.9 per cent.
1901 Quebec—53.6 per cent.

These figures indicate that in Ontario and Quebec, in 1891, 72 per cent. of all the infants dying in that year in Canada, died in those two Provinces, while in 1901, the percentage had increased to 85 per cent., and further, that the infantile death rate is about stationary in Quebec; while in Ontario it is on the increase.

GROUP XII.

The deaths in this Group are found in the following table, from which it will be seen that while 25.3 per cent.

of those dying of the ages 55 to 75 and over, were due to old age in 1891, the percentage in 1901 was 26.3.

	1891		1901	
	All Causes	Old Age	All Causes	Old Age
55 to 64 -	3993	45	5406	37
65 to 74 -	5223	641	6482	813
75 and over -	7647	3592	10877	5140
	16863	4278	22765	5990

Apart from senility the chief causes of death in those over 55 were

	55-64	65-74	75 and over
Tuberculosis - -	543	349	116
Cancer - - -	611	588	337
Apoplexy - - -	251	357	201
Organic Diseases of Heart	758	1144	779
Pneumonia - -	557	709	657
Bright's Disease - -	174	215	158

This unlucky number is very appropriate to this Group of causes of death, the figures standing 2,392 to 3,560—there being approximately one female to four males dying by violence, largely due no doubt to the hazardous occupations of the latter.

Of suicides there were in all 147—116 being males and 31 females.

This Group includes the deaths of 356 infants, due to starvation from want of breast milk—lives which possibly could have been saved had the parents known the proper use of milk for purposes of feeding their offspring.

That Our Lady of the Snows in her ice-bound winters is not so fatal to life, we note only 28 deaths from freezing, as compared to 49 from Sunstroke.

In this brief and very imperfect manner, endeavor has been made to epitomize the Mortality Returns of Canada, as taken from the Census Returns of 1891 and 1901, and to briefly refer to a few of the more important causes of death. With the establishment of the Census Bureau upon a permanent basis, under the able direction of Dr. Blue, we may expect the Census of 1911 to be more complete than that of 1901, and from time to time. I am sure, there will be issued from the Department bulletins replete with valuable statistical information and valuable deductions.

My chief object has been to impress on the public the importance from a sociological standpoint, the lessons to be learned from a statistical study of the deaths in Canada, more particularly as they relate to the deaths of infant Canadians. How many hundreds, if not thousands, of those lives could be saved annually if more attention was paid to the proper education of young men and women on the duties of fatherhood and motherhood, and setting forth a condition of affairs worthy of the careful consideration of the Federal and Provincial Governments who, if they would but devote one tithe of the sums of money at present appropriated annually for the study and care of animals to the more important one of human life and public health, particularly as it relates to our infant population, would, I am sure, be doing what this young nation requires and what is its just debt to generations yet unborn.

Municipal Health Officers' Section

PROBLEMS OF QUARANTINE IN CONTAGIOUS DISEASE WORK *

By FRANCIS GEORGE CURTIS, M. D.
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One subject which presents itself for careful consideration by health officers is the question of quarantine in communicable diseases. It is very important, not only because of the necessity of controlling as far as possible the spread of the disease, but also because in such work the health officer comes in close contact with the public and usually in a very disagreeable manner. It s no light matter for a man whose livelihood depends upon his daily work to have contagious disease break out in his household, and the object in view should be to have some method of control, which while effective shall also inflict as little discomfort as possible upon the household.

The question naturally divides itself into two heads; what shall be done with the patient, and what shall be done with the other members of the family during the continuance of the disease?

In regard to each of these questions there seems to be a great diversity of opinion, or at any rate of practice, not only in different States, but even in different localities in the same state; some communities seemingly believing that

* Read before the Section of Municipal Health Officers' of the American Public Health Association at Winnipeg, August, 1908

all that is necessary has been done when a warning placard has been placed on the house where the disease exists, while others enforce or try to enforce a strict quarantine of the whole family.

Such a variety of practice in a matter of such importance does not tend to impress the public with much faith in the efficiency of such work, and does cause a thinking man to wonder if the rules which he is instructed to observe are really necessary. Indeed, the writer has had a man call his attention to the fact that in the city where he had formerly lived, certain precautions which were being impressed upon him as important, were not required; and he wished to know why the same rules were not required in the same disease. A man who feels in that way is very likely to be lax in carrying out the rules which are laid down. It is with the hope that this section can and will formulate some uniform method of procedure which may be adopted, that the writer has ventured to bring up the subject.

Probably in the majority of communities some form of isolation in the severer forms of communicable disease is practiced, but the method as well as the degree of strictness is usually left to the local authorities.

In some places the patient is required in every case to remain in a room apart from the well members of the family; in others this isolation is not required but is recommended; and in some it is only enforced under certain conditions. Some cities place a card upon the door of the sick room, forbidding the entrance of any persons except "the attending physician, nurse and agents of the board of health." Others in addition require a sheet wet with a disinfectant solution to be hung before the door of the sick room.

In other places the sick person is only required to remain in the house, and is apparently allowed to mingle freely with the other members of the family.

Such are a few of the diverse requirements enforced in regard to the isolation of the sick person, and when we come to consider the length of time over which the isolation must extend the same diversity is found.

Of course the period of isolation varies with different diseases, but the length required for the same disease differs very much in different communities.

In many places the duration of isolation is left entirely to the attending physician in all communicable diseases, excepting perhaps in smallpox; in others the board of health fixes the period of isolation in certain specified diseases, and in all others it is left to the attending physician.

These periods of isolation where they are fixed seem to be as follows: in scarlet fever from three to six weeks; in measles from one to three weeks; and in small pox from certain definite periods which vary from four to six weeks, to a varying time defined as "until desquamation has ceased," or "until five days after desquamation is complete." In many other diseases the period is apparently left to the discretion of the health officer.

In diphtheria there is more uniformity of procedure and two negative cultures are usually required before the patient is released, although even here a slight want of uniformity appears in the fact that some cities require cultures from both the nose and throat, while others require it from the throat only; and some require the second culture to be taken by the physician to the board of health, while others do not.

The question of the time during which a child must remain away from school presents the same variety. Almost all States require by statute the exclusion of the child from the public schools during the existence of the disease. In some States a definite period must elapse after recovery before a child may return to a public school.

In Massachusetts this period was, until 1906, two weeks

after recovery from small pox, diphtheria and scarlet fever, and three days in measles. By a change in the law, made in 1906, the definite period was stricken out, and power was given to the local boards of health or the attending physician to issue a certificate allowing the child to return to school when all danger of conveying the disease has passed.

As a matter of fact many boards of health still retain a time limit, and many school committees have a regulation that no child may return to school after recovery from contagious disease without a certificate from the board of health.

This is at it should be, for the board of health and not the attending physician should be the judge of the fitness of the child to return to school.

In this very brief manner an attempt has been made to show the great diversity of practice which prevails in the method of treating the patient in cases of communicable disease, and when we consider the manner of treating the well members of the family in which the disease exists, or the other families in the same house, during the continuance of the disease, the same lack of uniformity is found.

In looking over the custom of the treatment of this part of the question we find that it varies somewhat with the disease.

Thus, in cases of small pox, yellow fever, and typhus, strict isolation of the family in which the disease exists is almost universally required and indeed, were it not required by regulation, the fear with which these diseases are usually regarded would in all probability compel almost complete isolation of the well members of the family.

In scarlet fever, diphtheria and measles we are again confronted with same lack of uniformity. In some cities the well children are kept in the house during the existence of the disease; in others they are allowed to go out without any apparent restraint.

The adults are usually allowed to go to work, but in such event are warned to be careful about coming in contact with the sick person when they are at home. Also where the adult's business brings him in intimate contact with children, as is the case with school teachers, or, in certain specified occupations, such as milkmen, bakers, and those who handle food stuffs, if he wishes to continue with his work he must leave the house where the disease exists.

In other places the well members of the family are allowed practically complete freedom as far as going about is concerned, but must not go to public places such as theatres and churches.

The other extreme is the rule found in certain cities that the well members of the family must be as completely isolated from the public as the patient himself; but it is very doubtful if such a rule can be enforced, especially in the more common diseases. In most States the well children of the family, as long as they remain at home, are excluded from the public schools during the existence of the disease, and for a certain specified time after recovery. In others they may return to school under certain conditions.

In Massachusetts, previous to 1906, the well children were rigidly excluded from school, as long as they lived in the house where the disease was present; and this, whether they had previously had the disease or not. In 1906 the law was made to read as follows:—

"A child who is a member of a household in which a person is ill with small pox, diphtheria, scarlet fever, measles or any other infectious or contagious disease or a household exposed to contagion from another household as aforesaid, shall not attend any public school during such illness until the teacher of the school has been furnished with a certificate from the board of health of the city or town, or from the attending physician of such person, stating that all danger of conveying such disease by such child has passed."

This allows a child who has had the disease previously to attend school provided the board of health is satisfied that the conditions are such as to make it safe for the child to go. It would be much better if the proviso about the attending physician were stricken out.

Nearly all the regulations, statutory or otherwise, apply to public schools, and it is the exception to find any rule in regard to private schools, although in one or two States they are specifically mentioned, as are also Sunday schools. In actual practice those in charge of private schools are usually willing to obey the rules of the board of health without any question, and see that they are carried out.

Persons who have been exposed to infection but who do not belong to a household where sickness actually exists are rarely, if ever, put under any restraint, although in some cities "exposed persons," either adults or children, must not be admitted to school, sometimes for a certain specified time and sometimes until the board of health has certified that all danger of infection has passed.

Such are some of the different methods which are used for the control of communicable disease, as shown by the regulations of local boards of health or by statute law; and if we should look into the details of the work, into the way in which these regulations are carried out when applied to individual cases, the variations would be still greater.

It is understood that it would be impossible in actual practice to apply a specific method of procedure to all cases, even of the same disease, because of the different conditions which are met with, such as the number of rooms in the house; the surroundings of the house; and the intelligence of the family; all of which must be taken into consideration. It would be worse than useless to attempt to apply exactly the same method of control to a case of scarlet fever occurring in a single house with plenty of available space, as

would be applied to a case occurring in a tenement with every room in use; but it seems that certain general rules of procedure could be formulated for the average case which could be modified slightly as might be necessary.

As most of the regulations spoken of are embodied in the rules of boards of health rather than in the statute law of the various States, there would be less difficulty in attaining uniformity as it would simply be necessary to change the rules of the local boards instead of the State law.

It is understood that it is impossible to fix a definite limit of duration for a communicable disease which will apply to all cases of that disease, but it is certainly possible to set a minimum limit of safety which could be increased in individual cases as might be necessary.

A long required period of isolation might inflict much unnecessary hardship in the majority of cases, and it would be much better to set a minimum which would be safe for the average case, with the understanding that it might be necessary to lengthen it in certain cases, rather than have a definite period of isolation which will cover the longest cases and compel shorter ones to remain in quarantine after it is safe to release them.

That it is not impossible to attain a large degree of uniformity in the method of handling cases of communicable disease is shown in tuberculosis, where the methods used in handling it show much greater uniformity than the methods employed in other diseases; and if this can be done in tuberculosis, which is in a way harder to handle because of the fact that there is practically no isolation, it ought to be practicable in diseases where isolation is required.

MANAGEMENT OF INFECTIOUS DISEASES IN RURAL MUNICIPALITIES *

By Dr. IRVING CLEGHORN
Baldur, Manitoba

In the rural municipality the conscientious health officer is the hardest worker, poorest paid, and most abused of all public officials. In order to do his duty he must turn a deaf ear to public opinion, as he is sure to be severely censured by many and commended by few.

It is a difficult task to make the public understand where the work of the health officer ceases and that of the physician begins, particularly as is the case in most rural municipalities where the health officer is also physician.

This position I have held for a number of years, and during my term of office have had some experiences, a few of which I shall refer to under the following headings:—

The Home, The School, and The Community.

In the home the chief difficulty is the tendency of the people to conceal rather than report a case of infectious disease, on account of their fear of quarantine, and it sometimes happens that unless some member of the family becomes seriously ill, no doctor is called and the contagion may spread to other homes before anything can be done.

There are various reasons why the public object to quarantine: Some on account of business, others because their children may be kept from school, while the greater number consider it an unnecessary expense, thinking children should have all these diseases during childhood. Therefore,

*Read before the Health Officers' Section of the American Public Health Association at Winnipeg, August, 1908.

I believe the principal reason is, that the public is not sufciently educated to the standard of sanitary knowledge. They think every man's house should be his castle, and can see no reason why even the health officer should interfere with their private life. They do not realize that the welfare of the home is to a large extent the welfare of the community and that one unsanitary home may be the source of infection to the entire district.

Sometimes a neighbor, fearing for the safety of his own family, reports a suspected case, whereupon the health officer has to perform the painful duty of almost forcing his way into the home, getting little else for his trouble than a clear conscience and the ill-will of the family, which, as a rule, they give generously, sparing nothing.

Thus you see the health officer must forego personal interest in order to do his duty to the public.

With regard to the school: Strange to say I find from personal experience that a very large proportion of the children attending public schools suffer more or less from some physical defect which, if taken in time, may be cured, but neglected forms the starting point of serious disease.

It therefore becomes almost necessary in the the interests of the children that the health officer should visit the schools at least twice a year. Errors of refraction should be noted and immediately corrected. Examine the mouth for carious teeth; these often cause disordered digestion and render the child susceptible to disease; also examine the nose and throat for adenoids; enlarged tonsils form the breeding ground for germs, while the adenoid growth decreases the lung capacity, thus rendering the child susceptible to tuberculosis.

During the past year our Province has been greatly interested in the selection of a suitable site for building a sanatarium, and providing in other ways for the treatment of tubercular diseases. But the old saying is very true, "An

ounce of prevention is worth a pound of cure," double true in this instance. Then why not take proper provisions for the prevention as well as the treatment of this "White Scourge," as it has been rightly termed.

A great many of our pupils are mentally dull, simply because they are physically handicapped; and although shelter is provided for the homeless waifs off our streets and money generously contributed towards supplying their material wants, still there are hundreds of our public school children today whose mental inactivity is caused by some simple physical defect, which might be remedied if taken in time.

Granted some parents attend to all of these things, but the majority neglect them through want of thought or education along this line. These things may seem trifles, but we must remember that "Trifles make perfection," and we should aim to have our children both mentally and physically as nearly perfect as it is possible for humanity to be.

If the country depends on the rising generation, surely our government should spare no expense in order that our boys and girls may grow up fully equipped and prepared to fight the battle of life successfully.

Referring to the community, among the many duties which may be mentioned are: inspection of back yards, alleys, closets, and stables, proper disposal of all refuse and debris, perfect drainage and a wholesome milk and water supply; also simple epedimics of measles, mumps, chicken pox, whooping cough, etc., which though trivial, offer considerable difficulty owing to the fact that we have the strong prejudice of the people to combat and must act tactfully to insure the best results for the public safety.

In infectious diseases, however, which are more directly fatal, as diphtheria, scarlet fever, smallpox, etc., we must be more rigid in our procedure; and in outlying districts not having hospital or modern facilities, we can only resort

to the machinery of the law and make the best of the means at hand.

I might briefly describe one instance in which I had an outbreak of smallpox, principally among the halfbreeds and in Rock Lake District, where I had to occupy the position of health officers as well as physician.

On my first visit of inspection I found ten cases in seven homes, and inside of the next nine days fourteen more developed among the suspects, making twenty-four in all.

The district covered an area of eight square miles, containing eleven infected homes and necessitating a drive of from ten to eighteen miles for me on each visit.

I vaccinated all those exposed and immediately placed the whole settlement under quarantine in charge of three efficient constables whose duty it was to rigorously enforce the law, and to see that the wants of the inmates were properly supplied, although the government makes no provision for this.

At the close I personally supervised the cleansing and disinfecting of all homes—result, on death, with no further outbreak.

Now as the health of the community depends largely on the efficiency of the work done by the health officer, he should be a specialist in his line, thoroughly educated in sanitary science. In his case, "A little learning may well be a dangerous thing"; therefore, in order to devote his time and best energies to this wide field of labor, he must be well and suitably paid. Few men in this western country can afford to be philanthropists, and we country doctors, no matter how good our intentions may be, have not the time or means to devote to this particular branch of study.

The people of Manitoba are awakening to the fact that Agricultural Science has hitherto been a neglected branch of learning. A college has been built where well-paid professors are ready to instruct all those who may wish to

study farming from a scientific standpoint. If only we could arouse a like interest in sanitary knowledge so that the people would work hand in hand with the health officer to exterminate germs and prevent the spread of infectious diseases, instead of either opposing or calmly ignoring his best efforts, how much more good might be accomplished.

For this reason I would strongly recommend a union of municipal health officers, to meet annually, for the purpose of discussing ways and means and to give and receive help from knowledge gained by hard-earned experience.

I am very pleased to see these four great countries joining forces, so that by their combined efforts they may more firmly establish the foundation on which to build the great truths of Sanitary Science.

THE DISINFECTION OF ROOMS*

By B. R. RICKARDS†
Columbus, Ohio

Some months ago the writer had occasion to collect statistical information regarding disinfection as carried on in the larger cities of the United States.

To this end a circular letter asking for information on various points was addressed to the Boards of Health of all cities in the United States of over 100,000 population. Answers were received from 29 cities and on these replies this paper is based.

Of these cities but five are now using generators alone, four others use a generator but combine it with other methods either occasionally or always, nine cities use the permanganate method alone and three others use permanganate combined with some other method. Nine use some form of solid formaldehyde—proprietary articles sold under various names, but five of these nine cities combine this method with some other to a greater or less extent.

One city uses a combination of formaldehyde, aluminum sulphate and quicklime; two cities use spraying only; two use spraying occasionally; one uses sulphur only; one occasionally, the former not believing in formaldehyde. One uses the sheet method and three use it occasionally.

So much for the methods employed—the striking features being the diversity of methods and the large percentage

* Read before the Section of Municipal Health Officers of the American Public Health Association at Winnipeg, August, 1908
† Written while Director of the Boston Board of Health Laboratory.

which use the solid proprietary forms, about which they evidently know little except what the agent has told them.

Of the 28 cities using liquid formaldehyde, by whatsoever method, nine or practically one-third buy it on analysis, one other formerly analyzed but does not now; two buy it on guarantee but do not analyze. The remainder trust to the honesty of the manufacturer; one city—evidently buying in small quantity—relying on the label on the bottle.

Seven cities appreciate the value of added humidity. One man on the other hand states positively that he does not deem it advisable.

The time of exposure varies from 3 to 24 hours, the majority requiring the room to be closed from 6 to 8 hours.

All the cities replying seal the rooms. Gummed paper is most commonly used but various other materials are employed. One city uses adhesive plaster, another adhesive tape; two cities use wet strips of newspaper; three others plug all cracks with cotton, paper or rags.

Seventeen cities test the results of disinfection by exposing cultures in the rooms, nine doing this as a routine procedure; the remainder occasionally or at stated intervals.

The cost of disinfection for 1000 cubic feet of space appears to be somewhat difficult to calculate, one city placing it as low as 7 1-2 cents. The average cost is probably in the neighborhood of 15 cents, but as some evidently count only the cost of materials without the labor, while others reply on a basis of so much per room, no reliable data can be given at this time. One city places the cost as high as 70 cents per room.

The amount of formaldehyde used per 1000 cu. ft. varies from one oz. of the solid material to 32 oz.

From the above compilation one fact stands out strikingly —each city is proceeding on a go as you please policy, adopting that method which happens to suit the immediate situation best from a standpoint of convenience and expense, regardless usually of the question of efficiency.

Chapin, in an article on the "Fetich of Disinfection," has called attention to the fact that disinfection was formerly a religious ceremony and that the attempt to give it a scientific basis was an afterthought. He has indicated that in the majority of instances infection comes from direct contact and not from formites and states that in his opinion disinfection has little value in preventing the spread of the common contagious diseases and instead of being a benefit is a powerful factor in preventing sanitary progress by encouraging belief in discredited theories.

Hill would modify this somewhat sweeping statement by limiting disinfection to chronic infections with a high mortality such as pulmonary tuberculosis, leprosy, etc., or where particularly active organisms with unusually high resistance such as anthrax are concerned.

Be our opinions what they may, it seems apparent from a review of the situation that in many cases it is impossible to conceive that the disease organisms are killed by disinfection as often as practiced. If such be the case, then, as Chapin suggests, immunity from recurrent cases comes because infection is not often carried this way. The writer's experiments, so far as they have gone, bear out this theory in many instances.

The present situation is intolerable viewed from a scientific standpoint. If disinfection is of value in any case then it hould be done in an efficient manner; a manner proved by exhaustive work to be reliable. If disinfection in general is not of value and can be proved to be of little or no value in any given disease, then disinfection in that case should be abandoned and trouble and expense thus saved.

Those of us that have carried out many experiments on disinfection, appreciate that there are many factors involved. Hill enumerates several, among them sufficient gas for a sufficient time, leakage, amount of wind, rapid evolution of gas, humidity, etc. By the omission or change of one of these the results obtained are changed. In other words, it is possible

to obtain almost any result if proper care is not taken in regard to the factors involved.

The amount of work involved in a proper solution of the problem is enormous, more than one man or a few men can hope to do.

By the formation of this Section a way is opened by which something of a start may be made. The first thing indicated is a consideration of the practical problems involved by municipal health officers,—a consideration of what is and what is not necessary in the way of disinfection.

By this means an enormous amount of laboratory work can be eliminated. After this is done it may be possible for the laboratory men by experimentation to lay down rules by which efficient work can be done with such diseases as the executive health officers may deem necessary. Provision should be made by the executive by which experiments may be carried out under very carefully controlled conditions,—then as in bridge and structural work a margin of safety can be applied and efficient work guaranteed.

Present conditions are farcical. Let us as technical men take some step toward the amelioration of such conditions.

THE PLEASURES AND HOPES OF THE HEALTH OFFICER*

By C. V. CHAPIN, M. D.
Health Officer, Providence, R. I.

Abstract.†

The paper refers in a light vein to the multifarious duties and small pay of the health officer. He is told that he must work for duty's sake, and for the pleasure of working, though sometimes unexpected recognition may be received. The health officer is to perfect himslf in his art, and to keep up with his science, and most of all is to do something, however small, to advance that science.

* Read before the Section of Municipal Health Officers of the American Public Health Association at Winnipeg, August, 1908

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1, 2, 3, 4, 5—see bottom page 372.

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THE MASSACHUSETTS ASSOCIATION OF BOARDS OF HEALTH

APRIL QUARTERLY MEETING

Boston, Mass.

The quarterly meeting of the Massachusetts Association of Boards of Health was held at the Brunswick Hotel, Boylston street, Boston, Thursday, April 29, under the Presidency of Dr. H. P. Walcott.

Upon the recommendation of the Executive Committee the following members were elected:

Charles Harvey Morrow, M. D., of the Gloucester Board of Health.

William Y. Fox. M. D., of the Taunton Board of Health.

William T. Jeffrey, of Salem.

A. L. Grover, M. D., of the Hyde Park Board of Health.

L. E. Young, of the Milton Board of Health.

William H. Spaulding, of the Leominster Board of Health.

E. G. Sherman, of the Mansfield Board of Health.

C. H. Stearns, of the Mansfield Board of Health.

E. Marion Wade, of Boston.

Michael Kelly, M. D., of the Fall River Board of Health.

Stedman Bixby, Ph. C., of Boston. Bacteriologist for D. Whiting & Company.

Edward B. Bigelow, M. D., of the Worcester Board of Health.

Arthur S. Hartwell, M. D., of the Norwood Board of Health.

Edward Knobel, of the Dedham Board of Health.

Edward A. Andrews, of the Cambridge Anti-Tuberculosis Association.

Howard F. Holmes, M. D., of the State Hospital, Tewksbury.

Report of Committee on "Appeal from Boards of Health."

The Committee appointed at the January meeting to oppose House Bill No. 690, on "appeals from boards of health," promptly met and arranged to go to the hearing. Philip S. Parker, Esq., a member of our Association, was engaged as counsel. All the members of the committee attended, all spoke, as did also Mr. Parker and a member of the law department of the City of Boston. There was a full and free discussion. The hearing resulted in success for the opponents of the bill, and the petitioners for the bill were in due time given leave to withdraw. No substitute bill has been offered, nor is any likely to be.

H. LINCOLN CHASE, Chairman,
LEWIS M. PALMER,
CHARLES E. A. WINSLOW,
Committee.

Report accepted.

Report on Committee on "Exposure of Foods."

Mr. President, The committee appointed to formulate regulations concerning the exposure of food stuffs, has carefully considered this question and submits the following regulations for your consideration. It is not the opinion of the Committee that these regulations should replace others where they exist but rather that they be used as a basis for regulations by boards of health of other cities and towns.

"No meat, poultry, game, fish, dried or preserved fruits,

dates, figs, cherries, grapes, berries, cut fruits, cut melons, cracked nuts, candies or confectionery shall be kept, carried, sold or offered for sale in or near an open window or doorway, outside of a building, or in any street, private way or public place of —— unless they be properly covered so that they shall be protected from dust and flies. No vegetables or other articles which are to be used as human food shall be kept or placed, or exposed for sale where it is possible for dogs or cats to befoul or otherwise come in contact with such vegetables or other articles of food.

"Every person being the occupant or lessee of any room, stall, building or place where any meat, fish, birds, fowl, milk, vegetables, butter, fruit or other articles intended or held for human food shall be stored, kept, sold or offered for sale, shall put and keep such room, stall, building or place and its appurtenances in a clean and wholesome condition."

Respectfully submitted,
FRANCIS H. SLACK, Chairman,
A. W. PACKARD,
HERBERT C. EMERSON.

Report accepted.

COW FAECES AS A SOURCE OF TUBERCLE BACILLI IN MILK

JAMES O. JORDAN, Bureau of Milk Inspection
B. L. ARMS, Bacteriological Laboratory
Boston Board of Health
Boston, Mass.

During 1908 an investigation was made, which was necessarily limited by reason of lack of time, as to the presence of tubercle bacilli in the milk and faeces of tuberculous cows, and in separator slime obtained in the commercial separation of cream from milk. The condition of the cows in the latter instance was, of course, unknown. This is offered as a preliminary report, and it is hoped later to continue the work.

The existence of tuberculosis in dairy herds, the fact that many animals, which react with tuberculin, pass tubercle bacilli with their faeces, and the present but abhorrent contamination of a large percentage of milk with cow faeces, were the causes which led to this inquiry. The specimens of faeces and milk were from cows which had all reacted to the tuberculin test. Reliance for results was placed wholly upon inoculation of guinea pigs. Sixteen specimens of faeces from as many cows, and five samples of milk from five of these cows were obtained. Subsequent to the procuring of this material, these animals were all killed, and in only one instance did the post mortem examination fail to reveal tuberculous conditions. In one cow no lesions were discovered, and the owner was indemnified for her loss. No evidence of tubercle bacilli was detected in the faeces of this animal.

Of the sixteen samples of faeces, four showed positive

evidence of the presence of tubercle bacilli; and included in the number which gave negative results, was the specimen from the above mentioned cow, where upon post-mortem examination no lesions were discovered. Eliminating the specimen from this animal, and taking as a basis for calculation the fifteen samples, where tuberculin test and autoposy indicated tuberculous conditions, 26.66 per cent. of the faeces samples contained tubercle bacilli. It must be borne in mind that only one specimen was procured from each animal. The post-mortem examinations showed generalized tuberculosis in three of the animals, and in the fourth cow, disease of the mediastinal gland was indicated. None of the milk samples gave positive results for the presence of tubercle bacilli, but this result was not unexpected; the milks were drawn under precautions which precluded faecal admixture, and contamination of tubercle bacilli could have occurred only through the udder. It would be both unwise and unsafe to draw any inference from the results upon the milk specimens, other than that these milks were free from tubercle bacilli. One of these samples was drawn from the cow, where the post-mortem examination showed no lesions. Speculation and generalization based on these findings, as to all milk from tuberculous cows being free from tubercle bacilli, would be fallacious.

Separator slime* is a grayish repulsive appearing mass, which collects around the bowl of centrifugal machines during the separation of cream from milk.

Nine of these specimens were subjected to examination by guinea pig inoculation, and of this number, three, or 33.33 per cent. were contaminated with tubercle bacilli. This is a somewhat higher percentage of positive findings

* A chemical examination was made of one or two of these specimens, and the results obtained follow:
No 1—Total solids, 27.02 %; fat, 2.75 %
No. 2—Total solids, 35.44 %; fat, 2.77 %; ash, 4.29%

than that shown by examinations of other investigators of slime, obtained elsewhere; but there is substantial agreement that† "about one fourth" of all the separator slimes from the commercial separation of cream are contaminated with tubercle bacilli. But not all of the tubercle bacilli, in the separation of cream from milk, go to the sediment. Many bacilli are removed with the cream, and Shroeder and Cotton* conclude that when they are present in milk, they will be present in greater concentration in cream."

The conditions shown by these examinations of faeces and slimes, and which accord with the results secured in other investigations, present a serious problem, and one requiring energetic action and co-operation of and support of the public. The exact manner in which the milk, from which the slimes were obtained,, was infected, is a question of minor importance. But the contamination was probably either through the udder, or from cow feces containing tubercle bacilli; and the fact that a large proportion of milk contains varying quantities of this filth,, demonstrates that this latter is a cource of infection to be feared.

Naturally this danger is increased in proportion to the number of tuberculous animals in herds, which are contaminating their feces with tubercle bacilli. Lack of cleanliness in barns, or dirty habits on the part of milkers would also be factors of importance.

Considering the large percentage of tuberculous cattle, and the probability of milk products being infected with tubercle bacilli, a question of grave import is presented, and one which has an important bearing upon the welfare of the public.

Regardless of controversies as to whether or not human beings contract tuberculosis from bovine sources, no one,

† Report of the Secretary of Agriculture, Washington, D. C., 1907, p. 30.
* Tubercle Bacilli in Butter, Circular 127, Bureau of Animal Industry, p. 4.

whether consumer, or scientist maintaining the negative of the above proposition, would knowingly use milk from tuberculous animals. Consequently the presence of tubercle bacilli in milk and milk products is one of vital interest to consumers, and while doubt exists in the minds of some, as to danger to the public from milk contaminated with tubercle bacilli, the latter should have all the protection, which it is possible for human agencies to devise.

These results emphasize the importance of clean milk, and the necessity of eliminating all cows reacting to tuberculin from dairy herds. But to a city of the size of Boston, and compelled to depend upon other States for a large portion of their milk supply, the problem presented is one not readily solved. Even if all the milk necessary to supply Bostonians was produced within the State, any attempt at legislation, compelling the employment of the tuberculin test and the cleansing of herds of reacting animals, would develop tremendous opposition on the part of owners of dairy herds. The correctness of this assertion cannot be gainsaid, and yet the difficulties as above outlined would be minor, as compared to the actual conditions of the present day, with milk coming to this city from at least five States outside Massachusetts. If this State legislated against tuberculous animals, such action would not compel the removal of animals similarly affected from herds located outside the State. To keep milk from tuberculous animals from entering the State is possible, but it is not a feasible solution of the problem, not at least until consumers are willing to forego, for a time at least, much of the milk now required daily.

The situation has more than one serious aspect. It affects most vitally the consumer, but considering the large percentage of tuberculous cows and the financial investment therein, the interests of the farming community cannot be eliminated from the final solution of the problem. But the interests of dairymen are minor as compared to the con-

sideration for the public, the welfare of which is of vastly more importance than the money issue.

It is questionable also if too much leniency has not been shown farmers in the matter of tuberculous animals, and if it is not a mistake to continue to idemnify them, as is now being done. This system of payment by the State has been followed for many years,, and cattle owners have meantime had an opportunity to become educated concerning the subject of tuberculous stock; but there is no sound reason for the indefinite continuation of the indemnifying plan. In fact there seems to be good grounds to assume that farmers are more lax concerning the purchase of cattle, less observant of proper stabling conditions, and are not as much concerned over the care of their stock, as would be the case, if the loss for tuberculous animals had to be borne by themselves? Has the time not arrived when the State should discontinue the idemnifying policy?

In this connection Dr. Theobald Smith* asserts that "the cattle owner raises his tuberculous crop each year, to be shouldered and paid for by public taxation. The only way to make any progress after these many years of patient compensation for diseased animals, is for the State to make them without compensation."

Would it not be better to devote the money now paid to farmers for tuberculous animals, to the application of the tuberculin test to all dairy herds, the loss for animals deemed dangerous to fall upon owners? There can be no more rapid or efficacious manner of preventing the purchase of animals not known to be healthy, and of obtaining the necessary sanitary surroundings, such as light and ventilation for the non-tuberculous stock, than that suggested. Farmers who once suffer a loss in this manner, will be careful to avoid further outgo for the same reason.

* The channels of Infection in Tuberculosis, Together with Some Remarks on the Outlook Concerning a Specific Therapy. From Transactions of the Massachusetts Medical Society for 1907

The policy for the State has been a mistaken one, in that its oversight has been directed to the pocket book of the cattle owner, rather than to the health of the consumer.

Federal action may be required to suppress the tuberculous cow as a source of food products for interstate commerce, but the all powerful factor necessary to produce the required legislation, whether federal or State, is the tremendous power of public sentiment. With that, and there is no question of greater importance to enlist the concern of humanity, than that of clean milk from healthy animals, the regulation of this important matter would be greatly simplified. Agitation of this vital question must continue until public opinion is sufficiently arroused to give the movement the necessary impetus.

Meanwhile to give protection to the public from the tuberculous cow, regardless of the manner in which milk may be infected, requires the pasteurization of milk products, excepting only raw milk drawn from herds shown to be free from tuberculosis by the tuberculin test, and which is produced under methods satisfactory to Boards of Health. There is every desire to avoid the sensational, but is it not the part of wisdom, while there is a possibility of danger from the tuberculous cow and from milk-borne epidemics, to invoke every known means to avoid that danger?

But such pasteurization must be properly performed, and the degree to which the milk is heated, and the duration of heating, must be sufficient for the destruction of the tubercle bacillus and other pathogenic organisms. Such treatment of milk should be by methods approved by health authorities and under their immediate control, and they should have power to destroy milk not properly pasteurized. In other words, let the pasteurization be efficient, or keep the product away from the public. This milk should be sold only in bottles, and the latter should bear a label stating the date upon which the milk was heated, the degree

of heat employed, and the length of time that the heating was continued. This milk should be delivered so that the bulk of it could be consumed within twenty-four to thirty-six hourse of the time that it had been heated. Milkmen may deem these propositions obnoxious, but those dealers unwilling to be thus regulated, had better cast their fortunes in other lines of business. But protection of public health is good business, and those who cater to their trade upon lines which give the consumer the most protection, are the ones destined eventually to win the largest financial returns. There is no sound reason, however, why those who are willing to conduct their business upon proper methods, should find oversight irksome.

But pubic concern in the suppression of the tuberculous cow should not be lessened by reason of milk supplies being pasteurized. The heating of milk should be viewed only as a temporary makeshift, and one to be discontinued as soon as the exigencies of the situation warrant such action. The freedom of milk from all excreta is a prime necessity. Clean milk from animals, not only free from tuberculosis, but from other bovine diseases, should be insisted upon, and every effort directed towards obtaining it. When this condition exists, the question of heating milk will be of secondary importance.

The procuring of the samples of faeces and milk was due to the courtesy of Dr. Austin Peters, Chief of the Cattle Bureau, Massachusetts State Board of Agriculture; and the examinations of the above material as to the presence of tubercle bacilli were made in the Bacteriological Laboratory of the Boston Board of Health, the laboratory at the time being under the direction of Mr. Burt Ransom Rickards, whose cooperation made this investigation possible.

DISCUSSION

DR. PETERS. The trouble in dealing with the problem of bovine tuberculosis is one of money. The Legislature grants an annual appropriation of $70,000 for the outside work of the Cattle Bureau and $7,000 for the office expenses. Out of the larger appropriation I have to pay agents for attending to other diseases as well as to tuberculosis. Agents have to see horses with glanders and investigate outbreaks of hog cholera and outbreaks of rabies, and agents have to be paid for examining cattle that are tuberculous. About all that can be done under present conditions is to try and give the State as good a system of inspection of the cows in the dairy herds of the state as we can, based on the physical examination.

Local inspectors of animals quarantine or owners report to us about—well, I won't say how many are reported, but the results of the agents' examination every year is that about 1700 to 1800 tuberculous cows are found that show physical evidence of disease or that have nodulated udders and are really the animals of greatest danger to the public health. The last few years I have gotten the appraisals down. I have trained the agents so that they cut the appraisals down pretty well, so that we pay only about $21.50 a head on an average for the cows. This costs about $35,000 to $38,000 a year that is paid to cattle owners, and there is usually a deficit in my appropriation, which is made good by the next Legislature. So it is hardly fair to say that it takes more than half the appropriation to pay for the cows, because I most always have a little money appropriated at the end of the year to make up a small deficit. I should think it took half of the appropriation that I have, counting the deficiency appropriation, to pay for the cows. Of course there are regular customers, who have cows condemned each year, and then there are other farmers, who occasionally have a cow taken and then

perhaps go two or three years or longer without having another taken, and under present conditions I think it hardly seems fair not to indemnify owners of cattle for their cows. The time may come when it would seem better not to pay for cows that show physical evidence of disease, but I don't know that it has arrived yet.

I think there are about 250,000 head of cattle in Massachusetts, and when you consider that only about 1800 bad cases are found that are condemned by the Cattle Bureau every year, it is only a fraction of one per cent., after all, of all the cattle in the state; considerably under one per cent. of the cattle that are of a kind to be much danger to the public health.

This work of Dr. Jordan's is very interesting, and I think there is no question but what the principal source of dissemination of tuberculosis in stables is through the faeces. It is only occasionally that a cow is found with a tuberculous udder, through which the bacilli are given directly off in the milk, but the ordinary way in which milk is contaminated is through the faeces. Cattle do not cough up and expectorate as humans do. A cow, if she coughs, brings material from her lungs up into her throat, and then swallows it, and it passes off through the intestinal canal. Consequently, where a cow has an open cavity in the lung and is bringing up material from the lung containing millions of tubercle bacilli, these bacilli are passed off with the faeces, and when the cow lies down she gets her tail in the gutter behind her, and when she gets up she whisks off flies and she smears more or less filth on her flanks. Then when this dries the milker sits down to milk, if the cow is not properly cleaned off, and particularly if the pail is an open one, the dry particles of manure drop into the milk and in this way it becomes contaminated. I think by killing off the cattle that show marked physical evidence of disease, or that have nodulated udders, that the

public health is protected in the greatest measure. It may leave some animals that are sources of danger, but they are less a source of danger than the bad cases.

The objection to testing everything with tuberculin is that a great many animals would be killed that might have only a small localized lesion, animals that had not come to a point where they would be a danger to the public health or to other cattle, and if the farmer did not thoroughly disinfect his stable, if he did not take pains to buy tested cows in the future, or if he got a little careless and perhaps saw a good looking cow that was not tested and bought her, as they often do when they originally intended to buy tested cows to replace those condemned, in a little while his herd would have as many animals in it that would react to a tuberculin test as in the first place. Until this work can be done in a way to obtain permanent results there is no use in testing cattle with tuberculin and killing reacting animals, when in two or three years the state would have to do the same work over again in the same stables. I think if this work was going to be undertaken it would require a good deal of money, a great many animals would be killed because of some slight local lesion that were practically sound, that the State would have to pay for, and ought to pay for, and that if permanent results are to be obtained the State would have to do the whole thing, that is, the farmer could not be trusted to disinfect; the State would have to have a disinfecting corps to disinfect the cattle stables as well as men to examine the cattle and test them and kill them. A very close supervision would have to be kept over the farmer in the future to be sure that every cow he had was a tested cow, and the State would have to test his herd every year, and then perhaps some day the inspector, much to his surprise, might find a lot of cases of tuberculosis through the disease having gained access to the herd again in some way.

While tuberculosis is as prevalent amongst bovines in this State as it is now, it would seem that unless work could be undertaken on a large scale and a great deal of money spent it is better to continue the present methods. All the cattle that are brought into Massachusetts from without the State are tested, a great many of them at the Brighton market every week, about 14,000 head a year are tested at Brighton, and some of these cattle that were held and killed were the ones from which Mr. Jordan obtained his material. If farmers could only come to a realization that when they take a tuberculous cow out of the herd they ought to thoroughly disinfect the stable, and when they go to Brighton to buy a new cow they would take pains to buy a cow that is tested instead of any good looking cow, I think greater progress would be made in the process of diminishing the prevalence of the disease than is being made at present. This is a campaign of education. Some farmers are intelligent enough to avail themselves of the benefits of this system, and others are not.

The PRESIDENT. The Association would be glad to hear the practice in other communities. We will ask Dr. Chapin what they do in Providence.

Dr. CHAPIN. We are not very far advanced in the work of checking bovine tuberculosis in Rhode Island. There are very few cattle condemned, and, as I said before, a great many tuberculous animals are imported into the state and a good many of them are slaughtered and eaten.

Professor SEDGWICK. Mr. President, I came in late and so missed the pleasure of hearing Dr. Jordan's paper, but he told me in advance what he was going to say. It may interest the Association to have just a word on what is being done at the moment in Chicago. There is a lively dis-

turbance on in that particular section over this same question.

Dr. Evans, the health officer of Chicago, is a very energetic person, and he startled people, I think it was six or eight months ago, by getting an ordinance passed, or at least by establishing the rule and seeking to get an ordinance passed,—I am not sure as to the exact legal status of things at the moment,—which provided that all milk brought into Chicago should be from tuberculin-tested cows, or if not from such cows, that it should be pasteurized under municipal supervision. There was of course a great disturbance on at once, and there is a more or less unfortunate clash between Dr. Evans and other health officials at the moment in regard to it. The matter I believe is still in the hands of a committee, but in the meantime Dr. Evans is going right ahead, and I heard him read a paper a few days ago, in which, as I remember it, he stated that already 60 per cent. of the milk of Chicago either comes from tuberculin-tested cows or from pasteurizing plants under the supervision of his officers, and he predicted that by the end of the year 90 per cent. of it will be derived in that way. This has been, as I understand it, a very interesting controversy, but Dr. Evans is apparently coming out on top. The thing is moving ahead well, and the people of Chicago, and many of the people of the state of Illinois outside Chicago, are earnestly backing up Dr. Evans I heard a well-known sanitarian of Chicago, whose opinion I value highly, say that he thought Dr. Evans was the most efficient health officer they had ever had there, and that he was supporting him in every particular; and in another part of the state, quite remote from Chicago, I got the same opinion from men of authority in agricultural matters and in matters of tuberculosis.

To show the need of something of the kind I may say that the herd of the University of Illinois, a herd kept on

the Agricultural College farm, which provides milk for the people in the cities of Urbana and Champaign, was tested a little while ago, and although supposed to be perfectly sound, out of 50 cows 19, as I remember it, reacted clearly. Experiments were then made on the dung and on the milk of these cows, and on their butter, and tubercle bacilli were proved present in all three,—in the butter to a rather surprising extent. They have excellent workers there, excellent bacteriologists and excellent agriculturists. As nearly as I got the trend of opinion, though I did not specially go into this matter, public and expert opinion ran very much along the line of Dr. Jordan's paper, namely, that we ought to work for tuberculin-tested animals, and in the meantime, as it would be obviously impracticable to get such animals at once without very great hardships upon the farmers, that we ought to prevent hardship upon the consumer by pasteurizing milk which has not been derived from herds properly tested. From all that I gathered I infer that within a year, possibly considerably sooner, the city of Chicago will be acting along these lines, and if so it will be a very interesting experiment to see what happens to the infant mortality and other conditions, hygienic and sanitary, of that city during the coming year. Personally, I believe that Dr. Jordan is quite right in this matter, and that we shall never get through with this thing unless we do adopt pretty radical measures some time and live up to them. It is always easy to put off the evil day. I don't say that the day has arrived at this moment, but I think it is high time for us to consider whether we are doing in Massachusetts all that we ought to be doing in this direction, so that I hail with satisfaction the ideas which Dr. Jordan has brought forward.

WHAT IS DISEASED MEAT AND WHAT IS ITS RELATION TO MEAT INSPECTION?

By PROFESSOR THEOBALD SMITH
Boston, Mass.

There has been recently discovered, more or less accidentally, a law among the statutes of this Commonwealth which has been interpreted as prohibiting the sale of meat from animals affected with local disease of however slight a character. This law is in conflict with the long-standing, well-tried and reasonable regulations of the United States concerning meat destined for interstate traffic. Under these circumstances I have been asked to introduce here a discussion on the text of disease and its relation to the inspection of meat. While turning the subject over in my mind I came to the conclusion that a general statement of the principles which should control the meat traffic would perhaps serve our purpose better than a discussion of a few kinds of affections which are specially hit by our present law. These can be taken up in the subsequent discussion by others.

The subject is in its larger bearings essentially a question of waste versus economy. The discovery of waste and its utilization marks many epochs in our material progress. We are everywhere beginning to see waste towards which we have been blind hitherto. To discover it means to utilize it. The enlightenment of any nation or community may be measured by its adjustment of means and ends to one another. If there is much waste in attaining a certain

end, intelligence is low, for human ends defeat themselves through loss of energy and resources.

Science furnishes us the insight needed to accurately adjust means and ends to each other. If science is worth anything to civilization it is in creating new values, making new classifications, transforming crude into more refined distinctions and leading us from emotional to rational states of mind which enable us to reconstruct the material world for better uses. Our present civilization is largely constructed out of what our savage forebears thought worthless, and in each successive step man has taken up something ignored or rejected by his predecessors. Without this process of readaptation and re-discovery advance would be impossible.

While science is building up, there is going on a continual tearing down, and our onward movement is measured neither by one nor by the other process, but by the difference between the two. It is often difficult to decide which process is more active. It is becoming evident on all sides that through unmeasured waste of resources, we have been exhausting our material capital, whereas we should be living only on our income. A sense of obligation to our posterity which also is a measure of enlightenment should induce us to come down to our income as soon as possible.

Unfortunately, the method of equalizing losses through insurance of various kinds, pensions, and taxes, shuts our eyes to the fact that every time property of any kind is destroyed by fire or otherwise it is absolutely lost. The community and the nation are by so much poorer. We have irrecoverably lost so much capital.

Among our material resources our food supply represents both capital and income. It stands for capital in so far as we are withdrawing the nutritive elements from the soil in the food we raise without always restoring them to the soil in some other form.

Flesh foods are among the most expensive of our food products. They represent the concentrated energy of vegetable foods made over by the animal body. During this transformation there is much loss of energy, some of which in the best kind of agriculture is promptly returned to the soil as fertilizer to maintain soil fertility. The modern world is addicted to the use of flesh foods. The great uninhabited territories of the western hemisphere have furnished for many years a rich supply to the entire world. This source is slowly drying up as agriculture takes up the land and gradually the raising of food-producing animals will have to become diffused and form an integral part of agriculture everywhere. In other words we shall have to look for a developing, local, domestic supply as is the case in European countries.

The influence of such a change,—from the great herds and flocks of the far West to the small numbers on the small farms everywhere—on the incidence of animal diseases will be marked. The great collections of animals on the prairies and uplands have been relatively free from disease. Few, if any, animals have been introduced there. The movement has been chiefly outward. Hence the chance for the introduction of disease has been slight. Parasitic diseases have been common in places, but the great plagues, unless indigenous and perpetuated in the soil, have been absent.

The domestic animals on the ordinary farm are in a somewhat different situation. There is more intercourse among the farmers and more movement among the animals themselves. This is especially true among dairy herds. Farmers while attempting to improve their stock often introduce infectious diseases. The country fairs and shows contribute much to the dissemination of animal plagues. The farm animals are furthermore subject to various accidents and to minor ailments, because they are overfed, overbred, and

underexposed to the healthful influences of air and sunlight. They are not so treated that the vitality of the species is likely to remain on a level. It will surely decline and even if we finally succeed in suppressing one plague, such as tuberculosis, another will in due time take its place to thrive on the unnatural conditions, unless we replace them by such as are more normal, physiological.

In view of the many possibilities of disease, both infectious and non-infectious, which the future has in store for our food-producing animals, we must therefore strive to maintain as far as possible the physical integrity of our domestic animals both by preventing infection and by raising their natural resistance to disease. In the meantime we must determine as far as possible through scientific means what pathological states of animals are dangerous to human health when the flesh is used as food. This is a complicated problem, for there are inextricably interwoven in it sanitary, esthetic and financial considerations, more or less in conflict with one another.

Taking first the sanitary aspect as the most important, let us endeavor to define under what conditions animals yield diseased meat. Here we must distinguish at the outset between diseases which are infectious, i. e., due to bacteria or animal parasites, and those which are not. Among the infectious diseases we must make a further distinction between those which are and which are not transmissible to man. Constitutional diseases not referable to infectious or parasitic agents are relatively uncommon, for our food-producing animals are as a rule killed at an early stage in life before decrepitude or the diseases of declining life, so common among human beings, have a chance to show themselves. I shall therefore refer to such diseases only casually. We are really concerned with infectious and parasitic diseases, for infections usually seize upon diseased states. They move in when health moves out and they

usually terminate life by grafting themselves on pathological conditions.

An examination of the field of animal pathology shows that we actually have few ideally healthy animals. It is hardly to be expected that we should have. The abnormalities encountered are of many kinds, ranging from the mere carriers of germs to various stages of local and general disease. Thus we find in the mucus from the throats of animals, bacteria which kill rabbits and guinea-pigs inoculated with this mucus. If we should inject a syringeful of blood from a healthy cow in the Southern States into a cow living in our own State, we should produce an infectious disease probably fatal. In the intestines of animals are found bacilli of tetanus and botulism and malignant oedema. In the winter infectious skin diseases may be seen on cattle otherwise in good condition. In certain regions actinomycosis of the jaw and tongue or even of the udder is not uncommon. Most cows after they have reached a certain age will show signs of recent or old tuberculosis.

Again animals not infrequently suffer from injuries which open the way for bacteria. Cows are apt to swallow pieces of baled-hay wire, hair pins, safety-pins, nails, etc. In some cases these pierce the walls of one of the stomachs and produce foul-smelling abscesses in the immediate neighborhood of this organ. Sometimes the infection extends to the liver. I have seen pieces of baled hay wire in various stages of migration from stomach to heart. Some years ago there were reported cases of cancer of the nictitating membrane of the eyes of cattle due probably to injury of some kind. Remains of pneumonia and pleurisy, peritonitis, former fractures of ribs and limbs are not uncommon. Animal parasites are usually present in the walls of the stomach and intestines and elsewhere. There is probably not a cow in existence which does not have

sarcosporidia in its muscles, filaria in abdomen or blood. The variety of such parasites increases as we approach warmer climates.

If therefore we should reinforce the naked eye examination with the microscope we should find still fewer ideally perfect creatures. None of the conditions I have mentioned would be considered harmful or objectionable with a sane, rational meat inspection service in operation.

Among the infectious and parasitic diseases which are transmissible to man we may mention anthrax, glanders, rabies, foot-and-mouth disease, tuberculosis, septicaemia and pyaemia, paratyphoid infections and trichinosis. The flesh of animals affected with these diseases is not known to be dangerous to man after thorough cooking, if we except those affections due to the group of paratyphoid or paracolon bacilli. This statement has a broad historical basis, for, in centuries past, flesh from animals thus affected was frequently or even regularly consumed. Each disease has to be considered by itself if we wish to single out and define the danger to man. The real danger in such diseases as anthrax, rabies and glanders lurks in the handling of the carcass and the uncooked meat by unsuspecting purchasers and in the further dissemination of the specific infection. Hence all traffic in any or all portions of carcasses affected with these diseases is prohibited and the slaughter of animals in which such diseases are recognized during life is forbidden for obvious reasons. Trichinous pork is harmless to manipulation, but highly dangerous as an uncooked food. Certain infectious diseases of animals not transmissible to man may be highly contagious to livestock in general and traffic in infected meat is forbidden on this account.

Perhaps the two animal affections which have caused the greatest harm to man through the food are trichinosis and various septic diseases of cattle associated with typhoid-

like bacteria. Trichinosis is eliminated by boiling the meat, but boiling has not in all cases destroyed the dangers arising from the second group of infections.

Passing from these acute, generalized, infectious diseases, to the localized, chronic types we reach a borderland between the so-called normal, healthy or sound, and diseased meat.

For example, actinomycosis may remain localized in some part or organ situated more or less superficially and the animal persist in a normal state of nutrition. The local affection may nowise disturb the physiological activities. In tuberculosis the earliest lesions are situated in lymphnodes associated with lungs or mesentery or throat or all combined. But the condition of the animal may be excellent. Where a rational meat inspection service exists such animals are considered sound and for good and sufficient reasons. Only where such localized diseases have overstepped certain well defined bounds, may we entertain a suspicion that perhaps the meat might not be absolutely free from the bacteria of the disease.

Of all the primarily local affections which may attack our cattle, tuberculosis seems at present singled out for the sharpest attack. Yet of all the localized diseases, there is none which is less objectionable to me than cases of primary tuberculosis of slight or moderate degree as sources of beef. The more localized a disease and the slower its progress, the better protected are the other organs through a slow development of immunity. The animal body is a large and complex community and disturbance in one place does not mean a general panic. Diseased conditions may thus be represented by gradations from the slightest local to the severest general disorders; from the most harmless to the most dangerous types of generalized disease. In any case the danger is greatly reduced, if not destroyed, by cooking. The danger in handling the un-

cooked article also varies according to the bacteria or parasites involved. With such a complicated situation before us it is obvious that it cannot be simplified by resorting to a town meeting vote, but must be treated scientifically.

Turning now to aesthetic considerations, we may maintain that it is disagreeable to think of eating the flesh of any animal which had the slightest blemish anywhere. Perhaps it is, but under the domination of this feeling we are better off to cast our lot with vegetarians. It is often easier to school our common sense and reason in such matters than our instinctive feelings. They usually win the victory. Such feelings, however, are possessed in widely different degrees by different nationalities. For example, horse flesh is used extensively on the continent of Europe. In Saxony, dogs are slaughtered for food.

Peculiar and contradictory conditions prevail in different countries, partly as a result of certain ingrained customs and habits. Pork is not inspected for trichinae in this country because it has at no time appeared very necessary to do so to protect public health against these parasites. Yet now and then cases occur and autopsies and dissections have shown that up to 5 per cent. of human beings in our country have been infected at one time or another. On the other hand Germany has established an extensive inspection service to detect trichinous pork, since more pork is consumed there than beef. The reason for this extensive service, which included in 1904 28,000 employees, is found in the fact that pork is frequently consumed uncooked. Severe and highly fatal epidemics have occurred which made this protective machinery necessary.

Contradictory customs and habits prevail among civilized nations with reference to bacteria themselves. I stated above that probably very few bona fide disease germs are dangerous when eaten in cooked foods. Yet there is a

tendency to go to extremes to avoid the possibility that any infection may be contained in the flesh even though such infection unheated may be absolutely harmless to human beings. On the other hand we take up to 1-2 million bacteria per cubic centimeter or 15 million per ounce in milk. Here we find microbes of all kinds and sizes, and of various shades of pathogenic and toxic power. We eat large numbers of bacteria in raw oysters during April, September and October of the open season. We seed our milk with lactic acid bacilli and incubate it so that billions may develop in it for curative purposes. Finally we ourselves are no strangers to bacteria. They occur on all mucous membranes and they make up about 1-3 the weight of the dried contents of the large intestine. They have even become beneficial under certain conditions. The subcutaneous injection of dead bacilli of various diseases promises to become an important means of not only increasing our resistance to disease, but even of curing us of persistent, longstanding, bacterial affections. Some years ago von Behring hoped to obtain from cows highly immunized against tuberculosis by the injection of the products of tubercle bacilli, milk which through its protective antitoxins might become a valuable curative agent. The hope has not yet been realized.

These illustrations will suffice to show that our objection to meat coming from animals not perfectly sound or healthy, leaving aside those diseases transmissible to man—is largely based on esthetic rather than on sanitary considerations and that our daily actions are hopelessly contradictory.

As a result of this state of affairs we find the inspection of meats governed by different regulations in different countries. Thus the meat inspection laws of Germany are far less exclusive, but at the same time more highly developed and worked out in minuter detail than in any other country. Diseased meat is there defined solely in accord-

ance with its potential danger to the health of human beings and to other still healthy domestic animals. Meat is classed as utilizable, non-utilizable and of inferior grade. A fourth class is created which is utilizable only under certain restrictions. These are that it be sold after sterilization, at a lower price and only in small quantities to any one purchaser. A certain percentage of animals which the U. S. inspector now condemns is utilizable in Germany. A larger percentage which he condemns is utilizable there under the restrictions mentioned. It having been learned that the flesh of animals affected with various types of pneumonia is harmless and not reduced in nutritive value, such flesh is classed as utilizable. About 1 per cent. of all animals are slaughtered because affected with diseases which induce the owners to dispose of them. If after inspection no reason exists for imputing any harmful qualities to the flesh, it is sold either with or without restrictions according to the nature of the case. I might give other examples of the operations of the German law, but they will suffice to show that the grading of meat is based on harmlessness and nutritive value, and that it is determined by rigidly scientific means. Moreover medical history has demonstrated through great self-imposed experiments of the human race in earlier times that flesh from most diseases is harmless if eaten after thorough cooking.

Coming now to our own situation, the question arises, where shall we draw the line? Who shall define it? What rulings will redound to the advantage of the masses of the people? These questions are difficult to answer. They involve individual and racial prejudices and grave financial problems. Any answer whatever presupposes in the first place thorough inspection of all meats destined for human consumption by trained inpection.

A set of complicated meat inspection regulations can be handled only by scientifically trained inspectors. The reg-

ulations are based upon what we know of the usual course of the disease, the behavior of disease germs within and without the body of the affected animal, their capacity for producing toxins, the nature of these toxins, and the natural immunity of the various tissues of the animal. No one but a well-trained veterinary graduate can be trusted to interpret such regulations. It may be stated truthfully that most intelligent, experienced butchers can distinguish normal meat from low-grade abnormal meat. They can tell whether an animal has diseased parts or organs, but there their usefulness ends. They cannot be expected to recognize localized tuberculosis for example and differentiate it from the generalized or advanced stages. Their judgment would be of little value in distinguishing local suppurative from general septic conditions. The trained inspector's function is to save meat wherever that can be done, rather than to reject it. The process of rejection is easy enough. It does not require technical training. It would not take long for one skilled in judging form, consistency and color to detect the ideally healthy animal. But there would be little meat handled and sold after his inspection if every minor blemish were counted against the animal. This is not what we can afford.

With the aid of trained inspectors it would be possible to satisfy various groups of people by classifying meat as is now done in Germany. The healthfulness of the article sold should be guaranteed by municipal, state or national inspection and the quality defined in accordance with other standards. It can then be left to the buyer to decide whether he wishes beef from ideally sound animals according to our present Massachusetts law at $1.00 to $1.50 a pound, or the article as passed by U. S. inspectors at 30 cents perhaps. He should also be permitted under certain restrictions to buy beef from animals, certain organs or parts of which have been rejected as diseased at say 12 cents

a pound. He should even have the opportunity to buy sterilized meat at 7 cents if he wishes it. Though we may be still some distance from the point where meat will be so classified and sold, yet I think we are moving toward it. With the growth of the domestic live stock industry we shall be forced to follow the older countries who have had to work this problem out for themselves. Without educated inspectors this cannot be done safely.*

A rational meat inspection service is the best which veterinary medicine can give to practical life. Some of the most conspicuous German veterinary scientists started as meat inspectors. It gives material for a life-long study of diseased conditions. The inspector, like the physician, must always be prepared to meet hitherto unknown pathological combinations. One who inspects animals reared in New England has much to learn if he should be transferred to the South, or to the West. Each territory has its own disease problems in addition to the common, universal ones.

In the final shaping of our meat inspection the economic or financial aspect of the whole problem will be of no small importance. It is obvious that the strictness with which animals locally or slightly diseased are eliminated from the meat supply will eventually be governed by the law of supply and demand. When we are very hungry we are much less squeamish about our food than when our tissues are continuously supersaturated with the daintiest that can

* That our national regulations are not perfect is shown by the following exemption of farmers' products:—"Section 14. When any cattle, sheep, swine or goats have been slaughtered by any farmer on the farm, and the carcasses, parts of carcasses, or meat products thereof are offered to any common carrier for transportation from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia, the common carrier may so transport such carcasses, parts of carcasses, or meat food products as long as the same may be identified as of animals slaughtered by any farmer on the farm."

The shipper is required to certify that such meat products are "sound, healthful, wholesome and fit for human food," etc. How "any farmer on the farm" is always able to tell us that his animals were sound, wholesome and fit for human food is somewhat beyond my comprehension. This section must be classed among those clauses which occasionally find their way into our laws and which seem to suspend the operation of the entire law in which they appear. This is evidently a sop to "the farmer on the farm." If such products were to be consumed by the farmer himself or in his household, it might perpaps be unreasonable to compel him to submit his products to inspection.

be supplied. If our meat supply becomes a diminishing quantity our laws will sooner or later relax and we shall come down more and more to the question of healthfulness irrespective of other considerations.

A rational meat inspection law will also aid the farmer in improving his stock and weeding out unsatisfactory animals. If we should exclude entirely from the market beef from cattle affected with primary tuberculosis of the lymph nodes or other organs in early or arrested stages, it would prove a serious obstacle to any further purification of our dairy herds from this disease. If the owner finds that all animals reacting to tuberculin are to be condemned as unfit for food, he will think twice before undertaking the complete elimination of tuberculosis. While we may be taking tubercle bacilli in raw milk we are vigorously opposed to the barest suspicion of having to take a stray dead bacillus in cooked beef. With a proper inspection the chance of any infection of the meat in the cases mentioned is extremely small, and the chance of any human infection from this meat infinitely smaller.

In the final adjustment we shall also learn that with a growing domestic supply of animals destined for food, public abattoirs will be necessary to properly carry out the regulations pertaining to the safeguarding of flesh foods. Small communities will have to band together and build sanitary slaughter-houses and forbid the use of small, private, usually filthy, killing places. Only in large municipal plants can well-trained, well-paid inspectors be fully utilized. The cost of properly inspecting numerous small establishments would be prohibitory and such inspection would have to be consigned to untrained, incompetent hands, with the result that the safeguarding and proper valuation of the product would be highly unsatisfactory under any law. It will be claimed that any attempt at classifying meat products will fail because lower grade meats, like

oleo-margarine, for example, may become the means of deception, misrepresentation and fraud. It will also be claimed that the people will refuse to buy lower grade meats. The first objection can, I think, be met by carefully limited sales. The second claim will probably prove to be unfounded if the healthfulness of the meat is safeguarded by a non-political, rigidly civil-service meat inspection force. Until that time comes we are all of us likely to eat at some time or other third-class meat, brought at first-class prices, even under a drastic law.

On the whole we have no moral right to withhold a valuable food product because there stands in the way certain popular misconceptions. Our esthetic sense is purely subjective, depending on individual and racial characters. It would be autocratic to attempt to embody in statutes the attitude of the most fastidious. Individuals should be free to choose and not be burdened by the subjective prejudices of others. In the case of our milk supply, standards based on nutritive values are becoming insignificant as compared with hygienic standards; so with meat, the nutritive and esthetic values will have to give way to standards measuring freedom from disease-producing elements. I do not mean that we should not establish and enforce standards of nutritive values, but they must not be permitted to overshadow the steadily growing importance of hygienic standards forced upon us by the increasing complexity of every-day life.

In conclusion let me summarize the principles I have endeavored to bring before you as follows:

1. There are few animals either ideally sound or wholly free from disease germs or parasites.

2. The line to be drawn between normal and suspicious or infected meat is not absolutely fixed, but depends on the nature and stage of the disease process.

3. In very few diseased conditions would the thoroughly cooked meat if eaten produce disease in man.

4. Animals affected with certain diseases are rejected in toto because the handling may infect man or disseminate the disease. Animals affected with other diseases are rejected partly because our general standards of healthy meat are relatively high, partly because such diseases may be disseminated by the meat and infect other animals.

5. The proportion of harmless meat from diseased animals excluded from consumption in the future will probably depend more or less on the relative scarcity of meat. With the shrinking of supplies we may eventually approximate the regulations now in force in Germany which permit a larger freedom in the use of meat from diseased animals than we do.

6. Proper inspection demands well-trained inspectors and these are most economically employed in large public abattoirs.

7. To utilize our meat products most efficiently they should be classified and meat from certain diseased animals now rejected entirely should be sold under suitable restrictions after sterilization.

DISCUSSION

DR. DURGIN. This paper and discussion have been brought about for the purpose of showing to all parts of the State a condition in meat inspection of the State which calls for a speedy remedy. We have two laws on our statute books concerning the inspection of meat; one enacted in 1898 is sensible and in keeping with the best scientific conclusions of the day; the other, enacted in 1908, on account of bob veal and for the prevention of cruelty to animals, was never intended for the purpose to which it has recently been forced, though its provisions are susceptible of the interpretation recently given by the Attorney General of the State, and which has thrown the local meat inspection service into a most ridiculous situation. This later law should be modified or stricken from the statute books. It is hoped that you will all take this matter seriously, and do what you can to favor a change in the present conflicting and humiliating state of our meat inspection laws.

DR. BURR. The practical side of the question, is that of the enforcement under the Board of Health's direction of this law as interpreted by Attorney General Malone. I, unfortunately, have been obliged to carry out the orders of the Board of Health, which were that Attorney General Malone's decision should be strictly enforced. We have strictly enforced it at the abattoir and we certainly have been placed in a very ridiculous position. If any one doubts that point, those of you whose duty it is to carry out this law in other parts of the State will agree with me, if you do your duty and enforce it.

I have brought with me a few figures, showing the results of about a month's work under this present law. During the month of April, we have condemned twelve

animals which would have been condemned under the old law, amounting to about 6,000 pounds of meat,—I mean the larger animals, cattle. Under the present interpretation, we have condemned thirty, making a total of about 20,000 pounds of meat, a difference of between 6,000 and 20,000 pounds under the old law and the present law. With hogs, we have had about ninety animals which have been condemned, only six of which would have been condemned if we had been working under the previous law, making a total in pork of a difference between 700 and about 15,000 pounds. The total result would be something like this; we have had 120 animals which have been condemned under the present law, 18 of which would have been condemned under the previous laws, and under the previous laws 6,000 pounds of meat would have been condemned, whereas we have condemned about 36,000 pounds of meat.

Now, it is interesting to know also what result it had upon the amount of killing. During the month of April, 1908, there were 2,511 cattle killed, 15 of which were condemned, with a total weight of 6,238 pounds. During the corresponding month of 1909, there have been only 1,100 cattle killed, with the condemnation of 42, and a weight of about 26,000 pounds. In the hogs we have had a difference in weight during the same month of between 900 and 15,000 pounds of pork. You can see that there is an immense drop-off in the number of animals killed, and also an immense increase in the amount of beef condemned.

I was very much interested, of course, in Dr. Smith's paper, and I hope that some of his views may be embodied in some resolution which might be transmitted to the present committee which has in hand this question of changing the law.

Mr. Jordan, in his paper, spoke of the use of tuberculin. I want to say a word in regard to that. He believed that milk from tuberculin tested animals only should be used

and if the milk of animals not tested with tuberculin is to be used, it should be pasteurized. It seems to me that the use of tuberculin with the idea of exterminating tuberculosis has been very much over-rated. I agree with Dr. Smith that the popular idea of eradicating tuberculosis by one injection of tuberculin a year is certainly wrong. When you consider the period of incubation in animals, of from a few hours, possibly, to a month, if you were to test a herd with tuberculin, and some of those animals were in the incubation period, of course you would get a negative reaction, and the result would be that you would leave those negative reacters, and some time later, perhaps the next year, in testing your animals, you would find those negative reacters giving a positive reaction. I think that is the reason why it is almost impossible to eradicate tuberculosis from herds in a practical way, and, as Dr. Smith says, you have got to retest your animals at least once in three months and even then carry out strict isolation.

PROFESSOR SEDGWICK. This whole controversy is a very entertaining one, and to anyone who is familiar with the history of sanitation there is nothing particularly new in it, at least to this extent:—it is not the first time that sanitation has been used as a political club. Germany, for example, for the sake of "protection," has at times been very careful about the importation of American hog products, and at other times, when less eager in that direction, been very much less careful, if I remember rightly. And we all recall the water-gas controversy, in which sanitation was dragged in by the ears to protect the health of the people, so long as it served a certain gas company to keep another one out. But when the two companies got together and divided up the spoils, then sanitation was forgotten. So that we all want to be pretty careful, and not be used as clubs to pummel somebody with. Sanitation is a beautiful

subject, but when it is prostituted to political purposes it becomes very much like other political things.

I did not rise, however, to say this so much as to say that I am very glad that Professor Smith has put the whole subject on what seems to me to be the true biological plane. I honestly believe that the food problem for this country is going to be in the next 25 years a very serious problem. It is certainly a sinister fact when, during hard times, food prices are rising; and when we remember, or stop to think, how a combination of bad crops in this country and in Argentina, or in one or two other countries,—a combination that might very easily happen,—would be very likely to bring us all pretty near the famine point in regard to our food supplies. If we look at the soaring prices of wheat, recently, (and some of us are not at all persuaded that these are wholly due to the manipulations of one man), I believe that Dr. Smith has sounded a timely note in saying that we have got to give heed to our food supplies; and that we have got to be very careful how we get into the habit of rejecting meat which can be shown to be fit for human food, simply for aesthetic or possibly political considerations.

Of course the greatest discovery, or one of the greatest discoveries, that man ever made, was the discovery of cookery. Our elementary school books tell us that cookery is done for the sake of developing delightful flavors, or of improving the digestibility of the meat, of foods of whatever kind. Those elements no doubt do play an important part; but Dr. Smith has told the truth when he has implied that thorough cookery would enable us to eat, and does today enable us to eat, a great deal of food which contains parasites. The rare occurrence of trichinosis in this country is chiefly due to the fact that we cook our hog products; and there is no kind of question that under the ruling which compelled Dr. Burr to reject those large quantities of meat a great deal of good food for mankind has been wasted.

Now, the time is coming when we cannot afford to waste that food, and it may be coming very soon. With the increase in the number of mouths in this country and in other countries; with the diminution in available acreage; with the shameful neglect of our sea-fisheries, and so on,—going on today in this State for example, so that we are wasting food in that direction,—the pusillanimous giving up of New England agriculture, because, so some say, "we can buy things cheaper than we can raise them," all these conditions within a few years, in my judgment,—and I have given a good deal of consideration to this question,—are likely to bring us, if there happens to come a combination of bad seasons in different countries, right up to the edge of famine; so that it is important for us, sanitarians and health officers, to get these big, broad ideas which Dr. Smith has given us, in order that we may take the right attitude towards this fundamental problem of human food supply.

It is all very well to say we want meat only from a healthy animal. Who is there in this room who can say that he himself is perfectly "healthy," and if he were to be killed for food today would pass Dr. Burr's inspection? Very likely not one of us. I am reminded of the difficulty which the medical students used to have in the old days when they studied with preceptors and went up to be examined. One story is that having thoroughly crammed up for the examination several young men confronted the board of country practitioners, who did not know much about the distribution of the popliteal artery or the ramifications of the brachial plexus, or if they did had forgotten them, but who were good, sensible doctors; and the old doctors gave to the young, would-be doctors, this question: "What is health?" and had no difficulty in flooring every one of them. Now, an equal difficulty meets us in this question, and if we interpret terms too closely, and claim

that health is perfection, then probably very little meat in this State would be deemed fit to eat.

THE PRESIDENT. Before we separate I should like to say one thing. The Board which I represent has only supervisory action over this question of the meat supply, and the real responsibility for years has rested upon Dr. Peters, and Dr. Peters and his department have met it in an absolutely satisfactory and reasonable fashion, until interfered with by recent events. One thing, however, that has become perfectly apparent in the course of the investigations that have been made during the last month under the direction of the State Board of Health has been this striking fact, that the State of Massachusetts has upon its statute books an absolutely complete system of statutory protection. I cannot imagine a better system of protection, and I don't know of any portion of it, except possibly in the city of Boston, that has ever been enforced. It is absolutely waste material upon the statute book. We have got to think upon one thing in the way of improvement, namely, a reasonable inspection of slaughter houses. We have not got it. You gentlemen who make up the local boards of health have all the power of the Commonwealth in that matter, and it is for you to see to it that your slaughter houses are in decent condition. They are not now in decent condition. They are not now fairly inspected, and the meat inspection that is carried on in them is an absolute farce. Men are receiving pay for services they never render, and it is time for the Commonwealth as a whole to see to it that something is done with these small slaughter houses which are an absolute abomination to the communities in which they are situated. I know what I am talking about, because there is one of them in Cambridge. It is an offense that the thing exists, and it is a reproach to the local authorities that it exists. Sooner or later you have got to

come, the community has got to come, to what Dr. Smith suggests, a collection of slaughter houses so small that they can be properly inspected. Each slaughter house ought to have, must have—a proper inspector, and he ought always to be in service, and no work ought to be done in the slaughter house when he is not in service. That is not true today.

DR. FROTHINGHAM. Dr. Smith suggested in his paper that the work of the inspector of meats should be the work of a trained veterinarian. I agree with him. My impression is that very few of the boards of health throughout the State of Massachusetts have a trained veterinarian as a member of their board. It seems to me it would be an exceedingly valuable adjunct to their board, and I would like to suggest to the members here that if they can find a suitable veterinarian in their community he should be made a member of their board of health.

MR. ELLIS. Mr. Chairman, following the discussion and the statements by Dr. Smith, I move that this meeting of the Associated Boards of Health favor the repeal of Section 1 of Chapter 329 of the Acts of 1908, and that if the matter is to be further dealt with it should be done by a commission of experts who shall make recommendations to the next Legislature (adopted).

THE PRESIDENT. Incidental to another question, I have asked that there be distributed certain pamphlets, papers, with regard to the prevention of blindness. The commission that exists for that purpose, a State commission, is doing most excellent service, and it naturally desires to call the attention of all thinking persons and all persons in authority to some means of preventing that most horrible of all calamities, the blindness of the young. I hope that everyone who has one of those pamphlets will earnestly

study it and do what he can in his own community to awaken public sentiment to the enormous importance of the subject represented by it.

DR. SWARTS. In respect to the question of opthalmia neonatorum, which you have just brought up, I would like to state that the State Board of Health of Rhode Island is endeavoring to educate the physicians to the necessity of preventing this disease, and has called to their attention within the last few weeks the greater prevalence of this disease, more particularly in that State, than was thought to exist. In order to accomplish this result the Board of Health is at the present time placing in the hands of every physician in the State an outfit, consisting of a small eye dropper containing a proper quantity of the nitrate of silver solution, of one per cent., properly enclosed within a box, in order that he may have in his obstetrical bag at the time of child-birth a proper solution of the proper strength, and not have to wait for five or six hours to look at his books to see whether or no it is one per cent. nitrate of silver or 40 per cent. formaldehyde that he should use in the child's eyes, or possibly in the country have to ride seven miles to get the solution, or find that his bottle is broken in the bag. What we propose to do is to place one of these in the hands of every physician, that he may have it ready in his obstetrical bag, placing reserve supplies in all the places where diphtheria culture tubes may be obtained. There can be no excuse then for any physician neglecting eyes which are liable to have this disease. It has been brought out that 25 per cent., I believe, of the blindness in many of the blind asylums is due to this ophthalmia neonatorum, a preventable disease, one which can be controlled, and it would seem as if everyone who is interested in the service of the public health, or the public purse, for they become State dependencies after a while, should take an interest in this matter and further this subject.

(Adjourned).

PERSONAL HYGIENE

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"The All or None Law."

Most current papers in any department of science must necessarily add to the complexity of our conceptions. It is a gratifying experience now and then to read one which simplifies an important matter. This distinction belongs in a high degree to a recent contribution of Keith Lucas.*

It is a fact so familiar as to be ignored that we grade our muscular contractions to our tasks, neither employing a useless excess of power nor wasting time in insufficient preliminary efforts. If our judgment of the required force is deceived we realize our error in a striking manner, as, for example, when we raise a bottle of mercury which we had supposed to be empty or pick up an empty box which we were prepared to find heavy. The explanation of the graded contractions has never been easy. How can a small muscular movement ever be produced? If a muscle is excited to the point of any response, why does not the internal disturbance prove contagious and cause a maximal discharge of energy? A muscle seems to resemble a magazine rifle in which we find a fresh charge quickly made ready after each explosion. But the analogy breaks down, for the energy set free at each shot from the rifle is inde-

* Journal of Physiology, 1909, XXXVIII, p. 113

pendent of the pull on the trigger. We cannot conceive of burning some powder in a cartridge and saving the rest.

The peculiar muscle composing the walls of the heart closely follows our analogy. If it responds at all to stimulation it makes a full-sized contraction and is for the instant exhausted. The statement of this property is referred to as the "All or None Law." The apparent disparity between the skeletal muscle with its exquisitely graded contractions and the cardiac type with none but maximal responses has now been cleared away. It is impossible to give the details of Dr. Lucas' ingenious experiments. The conclusions to which they lead are of wide application. It is the author's contention that the individual fibres of skeletal muscle cannot give graded responses. For the single fibre the "All or None Law" is entirely valid. The submaximal contractions made by muscles are the expression of the maximal shortening of some fibres and the complete idleness of others. Increasing intensity of stimulation gives greater and greater responses, merely because stronger stimuli rouse to action a larger proportion of the units. As soon as all the fibres are stimulated the maximum of shortening (or of tension) is reached. The difference between skeletal muscle and the contractile tissue of the heart really lies in the fact that in the first any number of the fibres may act without exciting their neighbors, while in the second, any local disturbance runs through the whole structure. Insulation of the striped muscle fibre is its most marked characteristic.

According to this view the fibres are of quite unequal irritability. If we could successfully apply the microscope to a muscle in partial contraction, we should see certain fibres short, thick, and tense, while others alongside would be relaxed and probably thrown into curves by the movement of their fellows. Are we to conclude that when we call upon our muscles to execute contractions of little or of

moderate force we always use the same fibres and that the greater part of the musculature is wholly unused? If so, we have a novel and surprising idea of the motor mechanism of our bodies. The importance of vigorous exercise becomes clear. Moderate exercise may be no exercise at all for the great muscular reserve of fibres hard to stimulate. On the other hand it may be that now one set of fibres and now another is conspicuously irritable. This last supposition is more in harmony with the usual good economy of the tissues.

Whatever else we may deduce from this new picture of muscular action, we shall find reason to emphasize anew the dominant position of the central nervous system. If muscle contractions vary in efficiency with the number of active fibres, it is imperative that the nerve-cells shall be able to call as many fibres as possible into action. When we consider the factors which assist in neuro-muscular training we include the actual increase of muscle substance and, probably, betterment of its quality. But we assume that the chief aim is in the accessibility of the muscle-fibres to influences from the nervous system. In terms of the conception we have been reviewing, the added power is largely secured by opening up channels by which nerve-impulses can be sent to groups of muscular elements long unstimulated. Thus too we may explain the strength of delirium or hypnosis. At the time of these exhibitions the muscles are in poor condition. Suddenly they are found acting with incredible power. We are perhaps witnessing for the first time in the patient's life something approaching a stimulation of all the fibres in the knotted muscles. Physical education is calculated to confer upon the man in health at least a partial command of these unrealized resources.

Another interesting consideration is in regard to the fatigue of familiar experience. We know that our sense of weariness and of incapacity for continued action is hastened

by dislike of what we are doing and postponed by interest and pleasure in it. The endurance displayed by women of slight physique when dancing is a case in point. The wonder of it disappears if we adopt the view that the ordinary voluntary employment of muscles is a fractional one. Seeming exhaustion may indicate fatigue of the nerve and muscle units habitually used. It may not be at all indicative of the state of a much greater number of elements less easily responding to volition. Add to will the auxiliary influence of afferent stimuli acting reflexly, and it is reasonable to suppose that we may cause the participation of many such fibres, distributing the burden more equally through the muscles employed and vastly extending the time of their performance.

VETERINARY HYGIENE

By W. L. BEEBE, D. V. M.
Bacteriologist for the Minnesota State Live Stock Sanitary Board

THE ECONOMIC IMPORTANCE OF TUBERCULOSIS OF FOOD PRODUCING ANIMALS.* The purpose of this paper is to call attention briefly to the serious injury which tuberculosis causes to the live stock industry from the economic standpoint and to suggest means of overcoming it, regardless of its communicability of animals to man. It must be realized that the exclusion of meat and dairy product of tuberculous animals reduces the quantity of available food, thus resulting in a tendency to an increase in the price of these two necessities of life, therefore concerning not alone the producer but the consumer. It is increasing alarmingly, particularly in hogs, as is shown by the federal meat inspection reports. The author states: "The two principal sources of data as to the prevalence of tuberculosis among live stock are (1) meat inspection statistics, and (2) record of the tuberculin test. Meat inspection throws light on the disease in cattle, hogs, sheep and goats, while the information derived from the tuberculin test is practically confined to cattle. The federal meat inspection as extended under the law of June 20, 1906, now covers more than half of all the animals slaughtered for food in the United States, shows that of 52,973,337 there were 788,269 or 1.46 per cent. Probably even a larger percentage are tuberculous in the animals that are slaughtered without inspection."

* A. D. Melvin, Chief of the Bureau of Animal Industry. Read before the International Congress on Tuberculosis, Washington, D.C., 1908. Published in the American Veterinary Review, Vol. XXXV, No. 1, pp. 18-32

For fifteen years the Bureau of Animal Industry has been preparing tuberculin and sending it to State and city authorities for official use besides using it in tests by its own employees. The tabulated results show that out of 400,000 cattle tested, 37,000 or 9.25 reacted to the test.

Out of 24,784 animals slaughtered, lesions were found in 98.39, and if the results from one State where the testing was not carefully done be excluded, accurate in 98.81 per cent.

The author estimates that the annual loss from tuberculosis in animals killed under federal inspection amounts to $2,383,433, and if the same conditions were applied to animals slaughtered without federal inspection the loss would amount to $4,354,855. The stock of animals on hand is also depreciating in value, because of tuberculosis. Assuming that living tuberculous milch cows are annually depreciating to the extent of one-tenth of what the loss would be if they were slaughtered, other cattle one-third and hogs one-half, the total depreciation amounts to 8,046,219. The annual loss from decreases in milk producing is estimated at $1,150,000 and there is also some loss from impairment of breeding qualities, etc. Taking all these items into account, the aggregate animal loss because of tuberculosis among farm animals in the United States is estimated at not less than $14,000,000.

THE RELATION OF BOVINE TO HUMAN TUBERCULOSIS.* The author gives a very careful review of the literature relating to this subject, and quotes many cases where circumstantial evidence points strongly to man being infected from bovine origin. These cases are divided into two groups; those that are of cutaneous and those of alimentary infection. After discussing in a

* W. L. Moss. John Hopkins Hospital Bulletin, Vol XX, No. 215, Feb. 1909

very thorough manner the investigation of cases by the British and German Royal Commissions and those reported by Ravenel, Theobald Smith, Fibiger and Jensen, de Schweinitz, Dorset and Shroeder and others a total is given which shows that of 306 cases investigated, the bovine tubercle bacillus was found in 63 cases, a little over 20 per cent.

The bacillus was obtained in 39 of these cases, either from the mesenteric lymph glands, from intestinal ulcers, or peritoneum, and in the other cases the bacillus was obtained from the cervical lymph glands in 19 cases, from the sputum in one case, and from a case of miliary tuberculosis, from a case of pulmonary tuberculosis, and from a case of tuberculosis of the joint. The fact that the bacillus was found 39 times in the abdominal organs and 19 times in the cervical lymph glands would point strongly to infection through the digestive organs by the use of milk, meat and other dairy products.

Calmette and others have shown quite conclusively that infection through the digestive tract is not of rare occurrence and that the bacilli will pass through the intestine and mesenteric glands into the lungs and there produce lesions where the bacilli rapidly undergo morphological and biological changes, so that they cannot be differenciated from the human type. Until it has been conclusively proven that the bovine bacillus rarely produce death in man it seems advisable to consider it a dangerous foe.

INFECTION AND IMMUNIZATION OF MICE AGAINST RABIES THROUGH THE ALIMENTARY TRACT.* Investigators have indicated the possibility of infecting and immunizing mice through the ingestion of rabies virus. The author found in his investigation that

* R. Repetto.-Compt. Rend Soc. Biol. (Paris) 1908, No. 15, pp. 716-718. Abstracted in Expt. Sta. Record XX, No. 6

the ingestion of rabies virus exercised a more or less pronounced effect in immunizing mice against a subcutaneous inoculation with street virus. All the rats with which the author experimented died of rabies as a result of feeding on rabies virus and 75 per cent. of the mice were also fatally infected by feeding upon virus for a month. After mice and rats had been immunized by ingestion of an attenuated virus they proved to be resistent to subcutaneous inoculation. In a further series of experiments with ten mice it was found that feeding for some time upon normal nerve substance brought about a quite pronounced immunity.

It has been found out by Nocard, Wesbrook and others that the virus of rabies is occasionally contained in milk. In dairy districts where cows are in pasture they are not infrequently bitten by rabid dogs, and it many times happens that the cow's milk is utilized after the animal begins to exhibit symptoms. Then there is a possibility that milk might be infectious before symptoms are demonstrated, the same as the case with saliva. Although it is infrequent that the virus is contained in milk it should be regarded as a source of danger to man.

MUNICIPAL SANITATION

By CHARLES V. CHAPIN, M. D.
Superintendent of Health, Providence, R. I.

SCREENING PRIVIES AGAINST FLIES.—On October 26th, 1908, the board of health of Richmond adopted some very strict rules in regard to the construction and maintenance of privies. Among other matters particular emphasis was placed on the necessity of making these buildings fly proof. It was even provided that all the old privies in the city should be made proof against the entrance of flies. The following are the rules which apply to old privy buildings:—

"The house shall be without openings or cracks through which flies may enter the house. It shall be provided with a tight self-closing door. It shall have an opening or openings for light and ventilation, which opening, or openings, shall be screened for the exclusion of flies.

The door of the house shall not be allowed to remain open at any time, unless there is a self-closing fly door, in addition to the door required under the above rule."

Levy states* that already many hundreds of privies have been reconstructed to fulfill the requirements of these rules.

GOWNS FOR PHYSICIANS VISITING CONTAGIOUS DISEASES.—The Department of Public Health of Philadelphia has recently provided a gown for the use of the physician, to be kept in every house where there is a

* Annual Report of the Health Department of Richmond, 1908, page 46

case of scarlet fever or diphtheria. The cost of the gown is $1.65, and of the box in which it is contained 40 cents. The following explanatory circular is sent out by the department of health:—

"To the Head of the House:

Sir—

As a convenience to your Physician, and as a means of preventing the spread of disease, we send you with this letter a case containing a cotton gown, which we hope will be worn by the Doctor while in attendance upon the case of contagious disease now in your house.

This gown and the case are the property of the Bureau of Health. They will be called for by a representative of the Bureau after the patient is well, and the sick room has been disinfected.

When not being worn by the Doctor, the gown must be placed in its case and kept there until the next visit of the Physician.

The outfit should be kept at the door of the sick room."

It is provided in the Philadelphia regulations that no person living in a house where there is a case of scarlet fever or diphtheria shall remove from the house until such person's clothes shall have been disinfected by the health department.

DISINFECTION OFTEN UNNECESSARY.—Lemoine* has found that disinfection is not as essential as has been claimed. At the military hospital at Val de Grace, certain rooms were used for isolating single cases of con-

* Rev. d'hyg, 1907, p. 1057

tagious disease. There was often such demand for their use that cases of different diseases quickly succeeded one another, sometimes without any disinfection, and often with slight disinfection. Sixty-five cases of scarlet fever, 41 of measles, 25 of mumps, 31 of diphtheria, 4 of small pox, 1 of chicken pox, and 136 of other diseases are reported as rapidly succeeding one another in these rooms. One case of measles and 4 of scarlet fever developed in the rooms. Often it was necessary to shift entire wards of 20 to 30 beds with only a slight attempt at disinfection. This was done a good many times during nine years without bad results.

The subject of disinfection was under discussion at a recent meeting of the Société médicale des hôpiteaux in Paris.† Comby, Courmont and Lemoine were decidedly of the opinion that disinfection as carried out in Paris by the municipal authorities during the last few years, has had no effect whatever in checking the spread of scarlet fever, diphtheria and measles. They conclude that it is especially useless in measles. It was stated that the official disinfection was a great annoyance, and often expense, to the infected family. Lemoine again spoke of his experience at Val de Grace, and stated his belief that placing so much emphasis on disinfection tended to draw attention away from the mild cases and carriers which are by all odds the chief factors in the extension of the common contagious diseases.

On the other hand, Remlinger‡ believes thoroughly in the importance of fomites as a means for the spread of disease. His arguments, however, are of the a priori type, or are based upon the reports of a few alleged instances of this mode of transmission. He does not seriously attempt to determine the numerical importance of this as compared with other modes of transmission.

† Bull. et. mem. soc. med. des hop, 1909, p. 588.
‡ Hygiene gen. et. appliq, 1908, III, 592-602.

BIOLOGICAL LABORATORY NOTES

By **FREDERIC P. GORHAM**
Bacteriologist, Providence Health Department, Associate Professor of Biology, Brown University

IDENTIFICATION OF MENINGOCOCCUS, GONOCOCCUS, ETC.—Differences in the fermentative action of the Meningococcus, the Gonococcus, Micrococcus catarrhalis, and other similar forms are reported by Dopter and Koch.*

They employ a medium as follows: To 75 c.c. of slightly alkaline agar is added 1 gm. of levulose, dextrose, or maltose, etc.; after sterilization 25 c.c. of ascitic fluid and 1 c.c. of sterile one per cent. solution of neutral red are added; the mixture has an orange tint and is kept in a water bath at 60 degrees C. for one hour, until a fine precipitate of neutral red appears, then the medium is poured into Petri dishes and cultures of the respective organisms are made.

The Meningococcus after 24 hours on the dextrose and maltose media gives a carmine-red color. On levulose and other sugars no fermentation occurs. The Gonococcus ferments dextrose only. The M. catarrhalis has no action on any of the sugars. The Pseudomeningococcus of Jaeger ferments nearly all sugars.

ANOTHER TEST FOR THE SEPARATION OF THE MEMBERS OF THE TYPHOID GROUP is that suggested by Chatterjee.† The whole surface of an agar

* C. R. Soc. Biol. Paris, 65, 1908, 351
† Centralblatt f. Bakt. Ite Abt., Orig, 48, 1908, 246.

slant is inoculated with B. typhosus and grown at 37 degrees for three or four days. All visible growth is then washed away with sterile salt solution. If the washed surface is reinoculated with B. typhosus no growth occurs, but if inoculated with B. paratyphosus, Shiga's Bacillus, or B. coli growth occurs after 48 to 72 hours at 37 degrees. If the same procedure is followed using B. coli or B. paratyphosus for the first inoculation, corresponding results are obtained with the exception that B. coli inhibits the later growth of not only B. coli but also B. typhosus and other bacilli of the typhoid group. These results are explained by the author as due to the production of a growth-preventing toxin which is insoluble in salt solution but which may be destroyed by heating to 55 degrees C. for one hour. Various combinations of cultures serve to distinguish the different members of the group.

THE ISOLATION OF A SINGLE LIVING BACTERIUM.—The use of increasing numbers of bacteria beginning with one living organism, for purposes of producing immunity, has led to the perfection of the technic of separating out one living organism. It has also given us an idea of the rapidity with which certain forms multiply when in liquid cultures. Webb, Williams, and Barker‡ tell us that when, into six microscopic drops of glycerin veal broth, single bacilli of a somewhat attenuated culture of B. tuberculosis were introduced, after 15 hours' incubation, five out of the six had doubled and the sixth had multiplied into three bacilli.

The technic of separating out the bacilli is as follows: Emulsions are made from a culture and individual bacilli are selected from hanging drops made from the emulsion according to the method of Barber*. The essential parts

‡ Journal of Medical Research, 20, 1909, 1
* The Kansas University Science Bulletin, 4, 1907, 8

of Barber's apparatus are an ordinary glass slide to which are cemented pieces of glass in such a way as to form a box open at one end and on top. This box is lined with wet filter paper and covered with a cover glass bearing a hanging-drop of the emulsion of bacteria. A very delicate capillary pipette is mounted in an adjustable holder on the side of the microscope stage in such a way that it can be inserted through the open side of the box and brought into the hanging-drop while both are under observation through the microscope. A single bacterium may some times be drawn into the pipette at the first trial. When more than one enter they may be placed in another drop of sterile medium and the operation repeated until a single organism is obtained. The presence of but a single organism in the pipette has been tested many times by stained preparations made from the contents.

Barber used this method for studying heredity in certain micro-organisms and has started cultures of yeasts, fungi, amebæ, and infusoria, as well as bacteria, from certain selected individuals of a culture. Already there are records of the isolation of single bacteria of anthrax, tuberculosis, typhoid, colon, influenza, and pus cocci by this method.

ANOTHER TEST FOR INDOL.—Still another addition to our methods for indol determination is that of Tobey.† Tobey concludes that the quickest, simplest and most accurate method for determining the presence of indol is by using the ring method with para-dimethyl-amido-benzaldehyde. This is a modification of Böhme's method which consists of

Solution 1. Para-dimethyl-amido-benzaldehyde, 4 parts.
Alcohol (96 per cent.), 380 parts.
Concentrated hydrochloric acid, 80 parts.

† Journal of Medical Research, 19, 1908, 499

Solution 2. A saturated watery solution of potassium persulphate (as an oxydizing agent).

To about ten c.c. of the broth culture of the organism add five c.c. of solution 1, and then 5 c.c. of solution 2, and shake the mixture. The presence of indol is indicated by the appearance of a red color, which becomes deeper on standing. Five minutes is sufficient in all cases for the completion of the reaction.

Tobey finds that in the ring method of applying the test Böhme's solution 2 is unnecessary. He uses Dunham's peptone solution for a culture medium.

FREQUENCY CURVES.—The question of fluctuating continuous variation and of mutation and of the influence of environment on bacteria is already receiving considerable attention. An excellent discussion of our present knowledge of these subjects and a further contribution to the question of the non-inheritance of variation among bacteria is given by Winslow and Walker.‡ They report a careful study of the variation of two types of the paratyphoid bacillus of Schottmüller, as regards acid formation in dextrose, determined by the method of plotting frequency curves. By a process of selection attempt was made to alter the mean of the curves of the two types but without success. The constancy with which the two types maintained their slight initial differences is an indication of the fixity of these bacterial types in the absence of modifying conditions of environment. Goodman§ has reported similar experiments with the acid production of B. diphtheriæ, but with somewhat different results. Winslow and Walker explain this as perhaps due to the fact that acid production in B. diphtheriæ is relatively variable, while in the paratyphoid group it is relatively stable. All of this work again calls

‡ Journal of Infectious Diseases, 6, 1909, 90
§ Journal of Infectious Diseases, 5, 1908, 421

attention to the great value of the method of working out frequency curves for the various characters of micro-organisms in determining types and species.

THE SERUM DIAGNOSIS OF SYPHILIS.—The rather complicated nature of the Wasserman test has been to a certain extent an obstacle to its introduction into general practice. Caulfield* has recommended the application of the test in capillary pipettes instead of in test tubes. This is a step toward simplification, but the method of Noguchi† to a much greater extent simplifies the process and will probably find favor with laboratory workers as well as with clinicians. It is as follows:—

Reagents Required.

1. *Anti-human hemolytic amboceptor* prepared in rabbits by injecting them five or six times in the peritoneal cavity with increasing doses (up to 20 c.c.) of washed human blood corpuscles, allowing five days interval between each injection. The serum is collected from the immunized animal eight or nine days after the last injection. The titre must be stronger than 0.01 c.c. for complete hemolysis.

2. *Complement.* Fresh guinea-pig serum.

3. *Antigen.* Alcoholic extract of organs or crude preparations of lecithin. To prepare the alcoholic extract of organs one part of mashed tissue (liver, kidney) is extracted with ten parts of absolute alcohol for several days at 37 degrees C., filtered through paper and the filtrate concentrated to about one-third of its volume, and the fluid preserved. To prepare the lecithin solution for antien, 0.3 gram is dissolved in 50 c.c. of absolute alcohol and then shaken with 50 c.c. of physiological salt solution and filtered. The filtrate must be clear.

* Journal of Medical Research, 19, 1908, 507
† Journal of Experimental Medicine, 11, 1909, 892

4. *Suspension of human blood corpuscles.* This is prepared by mixing one drop of the blood of a normal person with 4 c.c. of physiological salt solution.

5. *The serum to be tested.* About ten drops of blood from the patient are collected in a small test tube. The clear serum separated from the clot is employed for the test.

Method of Making the Test.

1. Take six clean test tubes (size 10 cm. by 1 cm.). In the first two of these, place one drop from a capillary pipette (or tube if necessary) of the patient's serum which is to be tested. In each of the second two tubes (which are to serve as controls) put one drop of the serum of a syphilitic case known to give the positive reaction. In each of the third pair of tubes (also controls) put one drop of the serum of a normal person. Now to each of the six tubes add 1 c.c. of the suspension of human blood corpuscles and 0.04 c.c. of fresh guinea-pig serum as complement. Lastly into one of each of the foregoing pairs of tubes put one drop of the antigen solution from a capillary pipette. The second tube of each pair receives no antigen.

2. After being well mixed by shaking, the six tubes are incubated at 37 degrees C. for one hour.

3. At the end of the incubation, add two units of anti-human amboceptor to each tube and mix well by shaking. Incubate the tubes two hours longer at 37 degrees C. Read the reaction from time to time for the next ten to twelve hours during which the tubes are kept at room temperature.

Reading the Reaction.

A negative reaction is indicated by complete hemolysis in both tubes irrespective of the presence of the antigen. On the other hand, a positive reaction is shown by complete absence or partial inhibition of hemolysis in the tube containing the antigen and complete hemolysis in the tube without the antigen.

This method can be carried out in the ordinary biological laboratory where work with sera is going on. Noguchi has still further modified the technic for use in the ordinary clinical laboratory. He has found it possible to dry the reagents on filter paper; in this form they may be prepared on a large scale by the commercial laboratories and placed within the reach of any physician. He gives his method of preparing the various papers required, viz.: anti-human amboceptor slips, compliment slips, antigen slips. In employing the filter paper slips they are dropped by means of forceps into the test tubes already containing the human blood suspension and patient's serum, in the order and at the intervals already stated for the regular test. It is necessary to shake the tubes a few times at intervals in order to insure proper solution of the reagents. The incubation may be carried out perfectly well in the vest pocket if a thermostat is not at hand.

CHEMICAL LABORATORY NOTES

By FRANKLIN C. ROBINSON
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FLOUR BLEACHED BY OXIDE OF NITROGEN.

For the last few years quite a controversy has raged with reference to flour beaching. On the one hand mill men have claimed that it was not an adulteration, and on the other food commissioners have claimed that it should be so considered, because it resulted in adding to the flour a definite foreign ingredient which might be harmful to health. As a positive contribution to the subject Mr. E. F. Ladd, food commissioner of North Dakota, has published (Chem. News, March 5, 1909) the results of his experiments on bleached and unbleached flours. These seem to him to establish the following as legitimate conclusions: When oxids of nitrogen are used to bleach wheat flour, both nitrous and nitric acids act upon the flour and form permanent compounds which remain in the flour. These compounds are in the oil of the flour and also in the gluten, and make the food products from such flour distinctly less digestible. Unless these experiments can be shown to be improperly performed, it seems that there is little chance remaining for argument in favor of bleached flour as a pure food product.

A good test for bleached flour is the so-called Griess test used for nitrites in drinking water, namely sulfanilic acid and naphthylamine acetate or hydrochlorid. These can be added directly to the flour in question. But a few flours when not bleached give the red reaction.

But if dry H_2S be drawn through a sample of flour for one hour it is found that bleached flours lose their whiteness, while unbleached are unchanged.

TEST FOR PURITY OF MILK SUGAR. When one gram of the finely powdered sample is dusted over the surface of concentrated sulfuric acid, in a shallow flat dish, kept at 15°c., no color will be observed in an hour if the sugar is pure, but even 1 per cent. of cane sugar present will give a yellow to brown color.

Milk sugar is also almost insolvent in dilute alcohol, while cane sugar is considerably soluble in that liquid.

BLOOD FROM PERSONS POISONED WITH CARBON MONOXID. It is well known that such blood differs in color from normal blood and its color is more stable. This difference is emphasized by diluting 100 times, and adding a few drops of copper sulfate solution, which gives at once a purple red color, while pure blood turns green. If a few drops of fresh tannin solution are added to such blood, it gives a red precipitate which remains unchanged in color, while pure blood under the same conditions gives a dirty red precipitate which changes to brown. The tests should be made without exposure to air more than necessary.

PURE AND ARTIFICIAL CIDER. The difference between pure and artificial apple juice may not be a question of great moment to public hygiene, but yet a simple test which shows the difference has such general interest that it seems worth the space it will take. It is taken from an article in the April number of the Analyst.

The raw liquid or a portion concentrated by evaporation is mixed with an equal volume of ethyl acetate and shaken at intervals for five minutes. After standing till separ-

ation takes place, remove the ethyl acetate layer and pour some of it carefully on the surface of lime water in a beaker. A yellow ring of color forms at the junction of the two liquids in all cases where pure apple juice is tested.

Artificial cider gives no color at all.

DISINFECTION OF BOOKS. The exposure of books to the fumes of formaldehyde in boxes or closets has proved to be an efficient method of disinfecting them, but it has the disadvantages of giving them an odor which is disagreeable, and which clings to them for a long time. With a few books this is negligible, but when for example a whole library or large collection of school books must be disinfected, and ready for use again within a short time, some other means should be used.

A most excellent one is to subject them to the vapors given off from boiling alcohol and water in equal parts. In order to prevent condensation which would wet the books, the disinfecting chamber and the books should be heated to about 60 degrees C before the vapor is let in, and if possible reduced pressure should be produced by partial exhaustion of the air with a pump. When this is done complete disinfection is brought about in half an hour and the books come out dry and fresh.

A NEW DISINFECTANT. Dissolve five parts naphthalene in 25 parts ether, add two parts crystalized carbolic acid and, when dissolved, add 100 parts spirits of turpentine. The odor is not objectionable, and the efficiency is high. Shaken up with water, 1-100, it forms an emulsion which is very effective as a germ distroyer. E. S. Gribinonk of Russia is its originator.

DUST LAYING OILS. Very many of these are on the market, and many of them are very efficient. The best of

them are non-drying mineral oils, not too volatile to soon evaporate nor too viscous to be greasy and sticky. An oil with specific gravity about .841 and a viscosity of from 30-40 at 20°c. is about the best. Some flavoring oil, as that of cedar or nitrobenzol may be added. Some contain a little carbolic acid for disinfecting purposes, but there is no advantage in this, for all such mineral oils are disinfectants of themselves.

There is no need for paying fancy prices for such oils on the plea that they are of special make, and the result of expensive experimentation. Any mineral oil dealer can supply them of the above constitution.

PUBLIC HEALTH LEGISLATION, NEWS AND NOTES

By F. H. SLACK, M. D.
Director, Boston Board of Health Laboratory

NORTH CAROLINA. The General Assembly of 1909 was very favorably disposed towards efforts to promote the public health. The appropriation of the State Board of Health was increased and the salary of the secretary fixed at $3,000 instead of $1,000 per year.

Under the new law the secretary must reside at Raleigh and devote his entire time to public health interests.

Dr. Richard H. Lewis, secretary of the board since 1892, worked hard for this new legislation and the fact that he sought no personal interest is shown by his resignation which takes effect June 30th. Dr. Watson S. Rankin succeeds him as secretary and executive officer.

While increased appropriations open up a new era in public health work in North Carolina, which will without question be carried on in a thoroughly competent manner, it is with regret that we see Dr. Lewis leave the position where he has labored so faithfully and effectively. The high esteem in which he is held by the public health workers of four countries was shown in 1907, by his election to the office of President of the American Public Health Association. It is hoped that his resignation from the secretaryship of the North Carolina State Board does not imply the abandonment of public health work by one whose long experience and ability make his services of great value.

WISCONSIN A REGISTRATION STATE.* The 1907 Legislature passed a bill requiring immediate registration, in all parts of the State, of deaths before interment and the direct return of certificates to the State Board of Health, thus placing the registration of deaths upon a fully effective basis, acceptable to the Census Bureau.

The admission of Wisconsin to the registration area of the United States, makes this area for the first time exceed one half of the total population of the country.

MONTANA. The Fourth Biennial Report of the State Board of Health of Montana, 1907-'08 contains the report of Dr. H. T. Ricketts of the University of Chicago, relative to his investigations into the cause and prevention of Spotted Fever in the Bitter Root Valley, carried on during the years, 1906-'08. For this work Dr. Ricketts was at the last meeting of the American Medical Association awarded the grand prize for original research.

Spotted Fever or Rocky Mountain Fever is formed in the northern and middle Rocky Mountain states and often proves fatal, both to man and animals.

The details of the investigation whereby the incidence of the disease is traced to the wood tick, the study of the life cycle of the wood tick, and the experiments proving the hereditary transmission of the disease in the tick are most interesting and instructive.

Since the disease is highly fatal in man, much attention was given to developing a serum treatment, but the number of cases on which this has been used seem yet too small for a satisfactory interpretation of the results.

Various hosts of the tick have been studied and methods are outlined by which the ticks may be eradicated.

The investigation has not as yet been concluded, but

* Wisconsin State Board of Health Bulletin, Oct.-Dec., 1908

there seems no reason in the light of what has already been done why with a proper appropriation from the state and intelligent co-operation of those in the regions affected the disease should not be eradicated.

VERMONT. The 1908 Legislature passed the following act regulating the sanitation of slaughter-houses:†

It is Hereby Enacted by the General Assembly of the State of Vermont.

Section 1. The State Board of Health is hereby empowered to make and enforce such regulations as it deems best for the purpose of controlling the sanitation of slaughter houses and other places where meat and meat products are prepared and kept either for sale or storage.

Section 2. All acts and parts of acts inconsistent with this act are hereby repealed.

Section 3. This act shall take effect from its passage. Approved Jan. 22, 1909.

AN ACT TO PROVIDE FOR THE PURCHASE AND DISTRIBUTION OF ANTI-TOXIN. It is hereby enacted by the General Assembly of the State of Vermont.

Section 1. The State Board of Health is hereby authorized to purchase antitoxin for the treatment of diphtheria and to distribute the same free of charge upon application therefor by physicians in regular standing under such rules and regulations as said board may prescribe and the expense thereof shall be paid by an order drawn by the auditor of accounts upon vouchers duly approved by said board.

A person selling or disposing of any antitoxin purchased or distributed under the provisions of this act for personal gain shall be fined not more than fifty dollars or not less than ten dollars. Justices of the Peace and municipal

† Vermont Medical Monthly, April 15, 1908

courts shall have concurrent jurisdiction of offences under this act.

Section 2. This act shall take effect from its passage. Signed Dec. 3, 1908.

AN ACT TO PROHIBIT THE DISCHARGE OF SEWERAGE or other Polluted Matter into the Waters of Ponds or Lakes. It is hereby enacted by the General Assembly of the State of Vermont.

Section 1. No person shall discharge sewerage or other polluted matter into the waters of any pond or lake having an area of 1000 acres or more, lying wholly within the state. A person who violates a provision of this act shall be fined not more than two hundred dollars nor less than twenty dollars. Justices shall have concurrent jurisdiction with the county court of offenses under this act.

Section 2. This act shall take effect Oct. 1, 1910.

Approved Jan. 27, 1909.

KANSAS.‡ Tuberculosis Campaign. The 1909 Legislature provides $10,000 a year for two years to the State Board of Health for the purpose of inaugurating a state wide educational campaign for the suppression and prevention of tuberculosis and for carrying out the provisions of a "compulsory notification" law.

Other public health legislation was passed including an anti-spitting law. The State Board of Health was also charged with the sanitary supervision of barber shops and public bath houses.

A law has been passed in Kansas making it a misdemeanor to purchase, trade or exchange a diseased animal for the purpose of disposing of the same for food, seller and purchaser being both liable.

‡ Bulletin of the State Board of Health, March, 1909

RICHMOND, VA.* The Richmond Health Department has secured a verdict in its favor in a test case in virtue of which more than 400 wells of the city which are said to be a constant menace to public health will be condemned and filled.

CHICAGO, ILLINOIS. The city health department has issued a regulation requiring that all milk sold in the city unless from satisfactorily tuberculin-tested cows, must be pasteurized.

RHODE ISLAND. The State Board of Health has sent to each practising physician of the state a small outfit containing 1 per cent. silver nitrate solution in a sterile vial, with a sterile dropper compactly arranged in a wooden case, to be used in treatment of the eyes of the new-born as a preventive of opthalmia. Duplicate outfits may be obtained by the physician at the State Culture Stations.

* Journal A. M. A., March 6, 1908

BOOK REVIEWS

Sanitation of Public Buildings. By W. P. GERHARD. John Wiley & Sons, New York, 1909.

One of the most pressing needs of the day is the popularization of scientific knowledge; and in particular, clear and readable expositions of sanitary practice are everywhere in the greatest demand. Books of this character are, of course, always open to the dangers which surround "a little knowledge." In subjects which, like sanitary practice, are so largely matters of detail, it is very easy to delude the reader into feeling that he has mastered a subject, of which he really knows very little. What the architect or the hospital superintendent or the director or the ordinary citizens needs is a statement of the problem which will indicate its importance and the general lines of its solution so that he will neither neglect the whole matter nor think that he is competent to deal with it himself.

Mr. Gerhard has succeeded to an unusual degree in producing books of this kind. As many as fifteen of them are listed opposite the title page of the present work, and these volumes, on various subjects connected with sanitary engineering of buildings and their protection from fire, represent a very solid and valuable kind of public service.

The Sanitation of Public Buildings includes what are practically five separate essays on Hospital Sanitation, Theatre Sanitation, Church Sanitation, School Sanitation and the Sanitation of Markets and Abattoirs. Several of these are reprinted and the tone and content of each is somewhat different. It is perhaps unfortunate that the chapter on hospital sanitation comes first, as this seems to the reviewer the only one which is not altogether satisfac-

tory. In this particular instance Mr. Gerhard has somewhat obscured his general principles by going into considerable detail in regard to water supply and sewerage,—detail which is too elementary for the sanitary engineer and which could only mislead the architect or layman who tried to follow it. Furthermore the important subject of ventilation, is curiously enough omitted from this chapter.

The other four chapters are written on a much broader and more suggestive plane. The chapters on the sanitation of theatres and churches are particularly admirable. The first is an enlargement of the paper read by the author before the meeting of the American Public Health Association at Ottawa in 1893 and contains that much quoted statement, "I know of at least one theatre in greater New York where each time the curtain rises a strong whiff of sewer air greets the audience." The evidence which Mr. Gerhard presents in regard to the abominable conditions of drainage and water supply which exist in most theatres and in too many churches will come as a revelation to many; and these papers ought to serve as powerful tracts in the missionary campaign for better sanitary conditions.

The chapter on school sanitation forms the most careful and elaborate section of the book and embodies a thorough study of German regulations in regard to school houses. This chapter includes discussions of the general location and site of the school, play-grounds, fire escapes, arrangement of corridors and stair cases, shape and dimensions of class rooms, lighting, ventilation, seats, wardrobes, methods of heating, and sanitary arrangements, and forms probably the best short treatise on school sanitation in English. There is also appended to this chapter an excellent bibliography. One section of particular value emphasizes the importance, just beginning to be recognized in all sanitary matters, of operation, as compared with original construction. It is as useless to build a good school building

and put it in charge of an ignorant janitor (a political appointee) as it is to treat a good water filter or sewage filter in the same way. This is undoubtedly one of the most discouraging features of the whole problem. When one remembers the recent efforts of the Board of Education in the city of New York to force the janitors of its school buildings to burn their ashes mixed with a magic powder, one realizes the difficulty of securing efficiency in this respect.

The chapter on markets and abattoirs is notable for its interesting historical summary of the subject and for its argument in favor of municipal markets. A public market building is one of the few things of real value which the human race owes to that misguided genius, Napoleon I.

One or two minor errors slip into every book. In particular the statement on page 54 in regard to sewage disinfection must be considered incomplete without mention of the most important of all sewage disinfectants, chloride of lime, which is far more efficient than permanganate of potash which Mr. Gerhard suggests and much more economical than disinfection by steam. On page 86 Mr. Gerhard points out the importance of serving pure water in theatres but the danger from originally polluted water is quite infinitesimal in comparison with the danger that follows the passing of a common drinking cup from hand to hand. In the interests of public health the passing of water in theatres should be entirely prohibited unless individual cups of paper can be provided.

On the whole the book can be highly praised as one of the most useful of Mr. Gerhard's many contributions to the subject. It is of the greatest value to young architects and ought to be in the hands of all those persons who are responsible for the erection and maintenance of the class of buildings with which it deals.

C.-E. A. WINSLOW

Practical Dietetics with Reference to Diet in Disease. By A. F. PATTEE. *Fifth Edition.* Published by the author. Mount Vernon, New York. Price, $1.00.

This appears to be a very practical manual. It draws its material from the best source and is a well-proportioned digest. It is not free from misstatements but these are of an academic character and do not impair the usefulness of the recipes and suggestions.

P. G. STILES.

Pure Milk and the Public Health.

A Manual of Milk and Dairy Inspection by A. R. Ward, B. S. A., D. V. M., Assistant Professor of Bacteriology and Director of the State Hygienic Laboratory, University of California, with two chapters by M. E. Jaffa, M. S., Professor of Nutrition and Director of the State Food and Drug Laboratory, University of California. Taylor & Carpenter, Publishers, Ithaca, N. Y.

No more important problem confronts the health officer of the present day than the proper oversight and control of the production and handling of milk, and interest in the practical sanitary inspection of dairies and in the safeguarding of milk supplies by bacterial analysis has been widespread during the past few years.

The problem is a many-sided one requiring exact knowledge of, and most careful attention to, widely differing details and the literature has been confined chiefly to reports of different investigations and systems of inspection, widely scattered in the form of papers in scientific journals, reports of committees appointed by various organizations, Board of Health reports, etc., etc.

Dr. Ward treats the subject in a comprehensive manner, taking up in detail the following subjects: The Contamination of Milk; Changes in Milk Caused by Bacteria; Epidemic Diseases Transmitted by Milk; Bovine Tuberculosis

and Other Cattle Diseases; Municipal Sanitary Control of Milk; Pasteurization of Milk; Microscopic Tests of Milk; Bacteriological Examination of Milk; Certified Milk; Chemical Analysis of Milk; Adulteration of Milk.

These various aspects of the milk problem are presented in an able manner; every detail of the production, care and inspection of milk receiving careful attention; the author has drawn freely from the work done by various investigators, and the list of references is particularly complete and valuable.

It is assumed that the reader possesses a general knowledge of bacteriology, and the book is written especially as an aid to the health officer, the veterinarian and the progressive agriculturist.

Dr. Ward's wide experience renders him especially capable to edit a work of this character and he has accomplished the task in a most efficient manner. Such a work widely circulated will be of great value in improving general dairy conditions and in establishing uniformity of technique in the various laboratory tests. Its low price, $2.00 net, postpaid, places it within the reach of everyone.

FRANCIS H. SLACK.

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